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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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BRIEFS

BATAAN NUCLEAR PLANT TO LAY-OFF 6,000--Balanga, Bataan, Jan 29--Some 6,000 skilled workers at the nuclear plant in Morong, Bataan, will be terminated any time from now due to lack of funds. However, Col Ernesto Kasintahan, chief of the National Intelligence and Security Authority in Central Luzon which provides security to the 620-megawatt plant, assured the workers that they will be relocated to fishing and reforestation projects of the government. It was learned that most of these workers are electricians and were employed by contractors and subcontractors like Westinghouse and the Manila Electric Co. About 25 percent of these workers are local residents while the rest are transients. RMD [Text] [Manila PHILIPPINES DAILY EXPRESS in English 30 Jan 84 p 2]

CSO: 5100/4357

POSSIBILITIES FOR NUCLEAR POWER PLANT CONSTRUCTION STUDIED

Bangkok SIAM RAT in Thai 3 Jan 84 pp 1, 12

/Article: "K.F.Ph. Revives Plans for Nuclear Power Electricity Plants"/

/Text/ Mr Kasem Chatikuanit, commissioner of the production section of the Electric Commission of Thailand /K.F.Ph./ stated that nuclear power electric plants will play a role again if the crisis in oil prices recurs in the future.

Mr Kasem said that 10 years ago was the time to build nuclerar power plants because fuel was cheap as compared with oil prices, that is, about 500 dollars per kw /kilowatt/. But now the price has increased to about 3,000 dollars per kw, plus increases in interest rates during the period awaiting construction. In any case, today nuclear power may be cheaper than power from oil, but that is because we have cheaper alternative resources for energy in the country, lignite and natural gas.

Mr Kasem went on to say that in the past plans for nuclear power plants were halted because of great worries about their safety. But, in any case, atomic power may come back if the price of oil reaches 50 dollars a barrel. The Electricity Production Commission has prepared various studies on nuclear power plants and is following all the news of developments abroad in terms of development and changes to more secure and safe systems. Nuclear power plants have the best safety systems of all electric power plants because they have more special precautions. And no one has yet died in an incident at a nuclear power plant.

Mr Kasem also said that today the cost of building a 1,000 MW /megawatt/ electric plant is about 2 billion dollars (not including interest). It would take at least 8 years to build.

Mr Kasem said that the Electricity Produciton Commission currently can produce the equivalent of 3,200 MWh /megawatt hours/ and the use of electricity increases 10 percent per year. If more are not built, within 3 years there will be a shortage of electricity. That is, in 3 years the quantity used will be equivalent to 4,200 MWh. If this happens, the government would probably solve the problem by building more oil electric plants, because at that point they would have to choose between a shortage of electricity and using expensive electricity. The Electric Production Commission had made preparations all along, but the Nam Chon Dam incident caused the preparations to be brought to an unavoidable halt.

9937
CSO: 5100/4356

BRIEFS

POSSIBLE NUCLEAR POWER PLANTS--Eight cities all over the country, it was revealed, have the luck to have been chosen as sites for setting up nuclear power plants. Mr Athon Pathumsut, secretary of the Office of Atomic Energy for Peace, revealed that early next year the International Atomic Organization will send experts to investigate avenues and sites for setting up nuclear energy plants in Thailand. Thailand has already investigated this /before/ and the following eight areas have been selected: 1) Cha-am, Petburi; 2) Khaonoi, Prachuap Khiri Khan; 3) Pan Chumkho, Chumphon; 4) Langsuan, Chumphon; 5) Khaochaison, between Nakhon Sithammarat and Surat Thani; 6) Pan Bangchak, between Nakhon Sithammarat and Songkhla; 7) Kao Kaeo, Krabilae; 8) Hatso. This project is receiving 30 million baht in aid money from Italy. Sites chosen must not be on earthquake faults or in heavily populated regions and must be places where heat from the plants can be released. /Text/ /Bangkok MATICHON in Thai 19 Nov 83 p 13/ 9937

MONACITE DEPOSITS--The Department of Mineral Resources of the Ministry of Industry has revealed that from its surveys of mineral sources and mineral wastes in three southern provinces it has discovered that Thailand has approximately 35,000 tons of good monacite sources. The Department of Mineral Resources discovered that ore while surveying to find out for certain how much monacite ore Thailand has to use as raw materials for the mineral extraction plant to produce nuclear power for use by the Office of Atomic Energy for Peace. Officials of the Department of Mineral Resources state that the department has performed its survey of mine and mineral wastes in 3 provinces--Phu Ket, Phang-nga, and Ranong--by surveying 222 mines. It discovered 13,700 tons of monacite and approximately 21,600 more tons of impure monacite in mineral wastes, altogether approximately 35,300 tons of monacite ore. The Department of Mineral Resources has stated that in fiscal year 1984 the department will move forward with a survey of another 343 sites in 20 provinces, 5 in the north, 5 central, and 10 southern. Monacite ore is a har-to-find mineral now used in charging high-power batteries and as a component in tubes for color TV's. /Text/ /Bangkok KHAO CHATURAT in Thai 10 Dec 83 p 10/ 9937

FUTURE NUCLEAR POWER PLANTS--The Office of Atomic Energy for Peace is preparing to build nuclear power plants and says foreign nations will help by sending experts to survey early next year. It is expected they will be ready in 10 years. Mr Athon Phatumsut, secretary of the Office of Atomic Energy for Peace, told reporters this past 18 November that because energy from oil has a tendency to be hard to find and will be more expensive in the near future, in order to

conserve oil used in production of electricity, the Office of Atomic Energy for Peace has joined with the production section of the Electric Commission of Thailand to set up nuclear power electric plants. The secretary of the Atomic Energy Office went on to reveal that he participated in the meeting of the International Atomic Energy Organization this past 4 October and requested aid from the nations at the meeting to set up such plants, and that aid from abroad appears certain. Mr Athon went on to say that experts from the organization will come to survey sites for those plants early in 1984. The surveys are expected to cost 30 million baht, and if permission is given to build, construction will probably take 10 years to complete. Furthermore, the most important component of electrical energy production with nuclear energy is uranium. The secretary of the Office of Atomic Energy for Peace said that from surveys of the nation it is believed that the land of northeastern Thailand, which is falt and high, contains enough of that ore to produce electricity within the country. /Text/ /Bangkok MATUPHUM in Thai 19 Nov 83 p 2/ 9337

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DEPUTY MINISTER DWELLS ON CONSTRUCTION METHODS OF ATOMIC PLANT

Prague JADERNA ENERGIE in Czech No 10, 1983 pp 345-347

[Seminar presentation by O. Tadzher, Bulgaria's deputy minister of energy: "New Methods for Construction of Nuclear Power Plants With Blocks WWER 1000"]

[Text] This report presented at the seminar held by the MHS [International Economic Association] Interatomenergo examines problems of an organizational and technological nature applying specifically to NRB [Bulgarian People's Republic] power engineering and oriented toward accelerating and cutting down on the time needed for construction of an NP [nuclear power plant] with WWER 1000 blocks, primarily of the fifth block of the NP Kozluduy.

An in-depth analysis of the organization of construction of the NP Zaporozhskaya and a survey of the potential for delivery of mechanized construction equipment by various enterprises provided the basis for deciding to carry out the construction and installation of the basic reactor part by the opencut method with the use of the West German mobile crane Demag with a caterpillar drive.

The fourth block of the NP Kozluduy was started up at full power in the NRB in June of 1982, an event concluding the first stage of the program for the development of our country's nuclear power engineering. Just as in all other socialist countries, our country also devised and approved the Program for the Development of Power Engineering in the Years 1980-1990, with an outlook to the year 2000. In keeping with the program, the basis for the development of Bulgarian power engineering is constituted by nuclear power engineering and by maximum utilization of local energy sources, primarily lignite. For the future, as has been the case up to now, it is envisioned to cover the demand for coal, liquid fuels and electric power by deliveries from the USSR without any particular increase in the volume of imports. Thus, the development of nuclear power engineering together with the utilization of local energy sources is becoming the basis for continued development of the country's power engineering.

The NP Kozloduy, with an output of 1,760 MW [megawatts], is one of the first power plants in our socialist camp to come equipped with a WWER 440-V230 reactor type. The first blocks were designed on the basis of the first concept of nuclear safety adopted in the USSR. After the 1977 earthquake in the RSR [Romanian Socialist Republic], surveys were undertaken in all countries afflicted by that earthquake with the objective of reassessing the standard of documentation for construction of NP's, primarily in seismic areas. On the basis of an in-depth analysis of the effects of earthquakes, Soviet research and planning institutes devised a special project with improved seismic resistance for the NP Kozloduy. This included the working out and implementation of many measures, including procurement of hydraulic shock absorbers and instrumentation for a system of emergency antiseismic protection from three countries. The program for improved antiseismic protection of reactor blocks is being successfully implemented. Many new arrangements were applied during the course of construction of the third and fourth blocks prior to their start-up.

Two variants of NP using reactors WWER 440 and WWER 1000 received consideration for use in the continued development of NRB nuclear power engineering. It was decided to undertake a transition to construction of WWER 1000 blocks. We realize that for a small country such as ours the advantages offered by this decision will be also accompanied by certain shortcomings. Elimination of the latter called for adopting the requisite measures. Thus, e.g., recently came the signing of the agreement with the USSR and the RSR regarding construction of a 750 kV [kilovolt] transmission line and a 400 kV twin electric power line which will interconnect our country's electrification system with that of the RSR and with interconnected electrification systems of CEMA member countries. Computation of the intersystem links shows that reliable operation of the NRB electrification system will be maintained even if there were to occur an outage of a block with an output of 1000 MW. In addition, provisions are made for mutual assistance during emergencies.

Simultaneously underway is construction of a hydroelectric storage power plant with an output of 880 MW which will operate in tandem with the seventh 1000 MW block. In this manner it will be possible to eliminate to a certain extent the shortcomings occurring in electric power networks in tapping the output of such a large block.

Construction of WWER 1000 blocks offers many advantages for our country. The key advantage is offered by the possibility of constructing a block in antiseismic arrangement by 1985, regardless of the fact that all the problems have not been solved as yet. In addition, construction of more powerful blocks will translate into savings of investment costs. The unified projection and standardization of the construction of these blocks--adopted by CEMA member countries--provide for accelerated construction and form a basis for using contemporary construction and installation technology, unification of start-up, repair of basic and auxiliary systems, production of replacement parts; these advantages will start bearing fruit in the future. On the basis of an analysis of the above-mentioned problems it was decided to build two WWER 1000 blocks at the NP Kozloduy and four blocks of this type at the second Bulgarian NP located near the town of Belene near the Danube River.

Construction of the first WWER 1000 block at the NP Kozloduy, as its fifth block, is of extraordinary importance, because the power generated by it has been included into the energy balance for 1986 and the subsequent period. In this context the Politburo of the BCP Central Committee and the NRB Council of Ministers decided on accelerating the construction and start-up of the fifth block at the NP Kozloduy. This marks the first time that a resolution for the construction of a specific installation was adopted at this level. A special staff was appointed to provide for coordination and resolution of all problems attendant to the construction of the fifth block of the Kozloduy complex in which are represented leading personnel of all ministries participating in construction of this block. The staff is headed by a member of the BCP Central Committee Politburo, the first deputy chairman of the NRB Council of Ministers.

The resolution itself, as well as the measures devised by ministries and organizations, lists the measures providing for timely completion of all construction and installation operations. Several agreements were signed with the Soviets with regard to NP design, establishment of a basis for construction and installation, carrying out of building and installation operations and others.

A viable program for the organization and implementation of construction and installation operations was worked out in connection with USSR standards and technical regulations. The time envisioned for construction of the first block of WWER 1000 covers 6 years and that for the subsequent individual blocks is only 5 years. We deem these construction deadlines to be unacceptable. For that reason, in addition to implementing several measures for mobilizing manpower, material and financial resources, the task for seeking new solutions to the organization of the conduct of construction and installation operations was promulgated. Bulgarian specialists studied in detail Soviet experiences gathered in construction, cooperated closely with teams of Soviet planning and design institutes in Moscow, Kharkov and Lvov and the team of builders of the NP Zaporozhskaya. On the basis of the analysis carried out we assume that there do exist certain opportunities for cutting down the construction deadline for the fifth block of the NP Kozloduy. Cutting down the construction deadline for each NP block is becoming of ever increasing importance not only in Bulgaria, because investment costs for NP construction keep increasing and every month or quarter by which the construction deadline can be cut is of great economic benefit to each country. Thus, our task is to find potential approaches to cutting deadlines for NP construction projects. In this context the BCP highly appreciates organization of this seminar. I would like to express my thanks to the CSSR minister of metallurgy and heavy machine building, C.E. Saul, and the general manager of the MHS Interatomenergo, C.F.Y. Ovchinnik, for the initiative they showed in assessing these extraordinarily important problems. Sharing experiences in NP construction forms the basis for rating the merit of potential approaches to cutting deadlines for their construction.

The problem of cutting construction deadlines is dealt with primarily by expanding the mechanization of operations. The total number of lifting operations during construction of the WWER 1000 block is on the order of

10,000. According to our computations, about 97 to 98 percent of these operations, carried out on the basis of technical specifications, can be performed by using the currently available mechanized equipment--BK 1000 tower cranes and cranes with a lower lifting capacity. The weight of a small part of loads (about 2 percent) exceeds 20-25 t [tons]. Such loads call for use of heavier mechanized equipment. The USSR developed a full-portal gantry crane with two hooks of a lifting capacity of 100 t each. This arrangement offers many advantages, but also poses substantial shortcomings. The advantage is constituted by the possibility of using these cranes for lifting the huge blocks assembled in production plants. In this manner it become possible to expand the scope of preparation for construction and merely assemble the individual blocks on the construction site. For example, the reactor body at the NP Zaporozhskaya was assembled in the course of 20 days, which represents an extraordinary accomplishment. However, all of that could be achieved only on the basis of a detailed technical preparation of problems, starting with the project for production of the blocks in plants.

The shortcoming of this solution is constituted by the need for the cranes to travel on rails from both sides of the reactor housing hall, interfering for a certain amount of time with the carrying out of other operations. Things get even more complicated when the cranes must also service the power plant's machine room. In addition, use of these cranes is feasible only for lifting maximum loads; for the rest of the time they are used inefficiently.

On the basis of these facts we examined additional possible variants for carrying out construction and installation operations. The basis of the examined variants was formed by weighing the relative merits of using mechanized equipment with a high maximum moment of load--on the order of 200 kN.m (kilo-Newtons per meter)--without travel on rails and also the possibility of using the "open" method for installation of the reactor, steam generators, volume compensator and the reactor lid. In this connection were studied possibilities for procuring cranes of some leading companies, such as "American Hoist", "Demag" and "Liepherr".

As is well known, the crane used in the construction of the NP Zaporozhskaya has a maximum moment of load of 100 kN.m. This crane facilitates the installation of large assemblies, but at the same time it causes certain limitations during construction that have already been mentioned. While this problem can be solved by using several lifting mechanisms, there still remains a certain amount of risk.

The "American Hoist" company was unable to fully meet our needs, because the jib geometry and tilt moment of their crane are limited. The "Liepherr" company did for all practical purposes meet our requirements, even exceeding them to a certain extent. The weight of cranes of the "American Hoist" and "Demag" companies ranges between 280-290 t, the weight of the "Liepherr" company's cranes exceeds 500 t, a fact that becomes reflected in their prices.

On the basis of the results of the assessment of technical and other data provided by the cited companies we decided to use the caterpillar-type CC-4000 mobile crane with a large lifting capacity, a product of the "Demag" company (FRG). The CC-4000 crane has the following technical features:

--engines--2 units with 257 kW each;

--weight--285 t at caterpillar track width of 1,500 mm;

--counterbalance weight--140 t;

--distance between track axles--9.5 and 10.5 m;

--maximum moment of load--40 kN.m (190 t at 18 m).

By means of attachments it is possible to assemble "Ringlift" and "Superlift" systems and significantly improve in this manner upon the features of the standard crane.

The "Ringlift" system is assembled by means of a special annular adapter. The adapter is provided with an arm and a lifting frame and transfers the load onto its path of travel by means of 32 rollers. Along with the crane its truck also moves carrying the counterbalance (700-1,000 t, depending on the load being lifted).

The crane acquires varying geometrical and loading characteristics by means of two auxiliary jibs of 36 and 60 m in length which meet the requirements for installation of all the assembly blocks in the reactor section, including the reactor vessel, steam generators and the reactor lid.

The "Superlift" system uses a counterbalance weighing from 0 to 250 t, depending on the weight of the load being lifted. It also allows for various combinations of jibs.

The crane's mobility with its own drive mechanism facilitates its use in a reactor hall with two blocks as well as in the machine room and the auxiliary operations building.

According to technical data and company guarantees it is possible to disassemble the crane into individual blocks weighing 80 t. Broken down to these blocks the crane may be transported to other sites, contributing to improved efficiency of its use.

Use of the CC-4000 crane also cuts down demand on other lifting mechanisms. Thus, e.g., in the auxiliary operations building it is possible to substitute the BK-1000 crane by a BK-300 crane. Some advantage might also be derived from examining the possibility of substituting the SKR-2200 and SKR-3500 cranes in the reactor hall with BK-1000 cranes, and BK-1000 cranes in the machine room with BL-300 cranes. To put it briefly, the lifting capacity of the remaining mechanisms on hand could be increased by an order of one.

The construction of the reactor part of the fifth block of the NP Kozloduy is divided into six stages. The organization of construction up to a level of 13.20 m (the first stage) is abridged in the manner envisioned by the program of organization of operations worked out by the Soviet design and planning organization. In our opinion, the subsequent stages of construction could make use of a new technical solution--using the "open" method for carrying out construction and installation operations in the reactor hall. That method was used for completion of construction and installation operations during the first and second stages of construction of the reactor hall of the NP Kozloduy that uses WWER 440 blocks. This method makes it possible to resort to supplementary lifting mechanisms in case of need.

Construction of the reactor shaft of the fifth block with internal hermetic zone structure up to a level of 20.70 m (second stage) envisions use of the CC-4000 crane for blocks weighing in excess of 40 t. The crane will operate in a stationary position in the "Ringlift" system and will provide for timely installation of technological equipment into the unfinished structure. Due to the potential increase in size of the blocks for construction of the reactor shaft and its cylindrical part, it became possible to reduce the number of basic blocks to 20-25.

The installation of the internal hermetic zone structure from the 20.70 m level to a level of 36.90 m and of the cylindrical part up to a level of 51.60 m (third stage) is also carried out by means of steel blocks increased to maximum size and utilizing the CC-4000 crane. It will be possible to achieve a twofold decrease in the number of blocks for the cylindrical part, down to 12 or 24, depending on the production variant and installation of reinforced blocks.

It was decided to connect the envelope blanket up to a level of 61.0 m (fourth stage) into 6-8 blocks, which also can be assembled by means of the CC-4000 crane. It is envisioned that the cupola part of the envelope (fifth stage) will be assembled in front of the reactor hall and, after control assembly on the test stand, will be lifted for installation as a single block, weighing 190 t, by the same crane.

Construction and installation operations pertaining to the building of the ventilation stack (sixth stage) do not pose any difficulties. In essence, this can be done by means of tower cranes. After preliminary assembly at a 0.00 m level, the ventilation stack is installed in place as a single block.

The problem relevant to the conduct of concreting operations were also subjected to detailed study and analysis. In our opinion, use of mobile concrete pumps, even though representing an advanced technique, is not sufficiently effective.

For that reason we developed in our country a new organization of concreting operations which envisions the establishment of a centralized concrete mixing plant directly at the construction site. The concrete mixture will be transported to the point of imbedding by means of stationary concrete mixture pumps.

The installation of technological systems in the reactor hall takes place in three stages: combined construction and installation, basic installation and "pure" installation.

During the stage of concurrently progressing construction and installation operations it is expected that a minor part of some systems (overhead traveling cranes, heat exchangers, tanks, foundation components, dry shielding, fulcrum truss under the reactor and others) will be assembled.

The greatest volume of installation operations during the basic installation phase will be carried out by means of a polar crane with a 320 t lifting capacity.

At the "pure" installation stage equipment and pipelines that are in contact with coolant of the primary circuit will be installed.

According to the procedure for the use of the technology that we are proposing, it is envisioned that the CC-4000 crane would be used during the second, third and fourth stages of construction operations for the latter and, depending on the extent of completion of the construction part, for the installation of a large part of the systems that are to be installed in the basic installation stage. The proposed "open" method of installation offers an advantage in that lifting and installation of heavy units of handling equipment can be accomplished without resorting to the use of a special transportation corridor. According to the preliminary assessment of the technological procedure that we are proposing, installation of the reactor hall equipment could start 6-8 months ahead of the planned schedule. The proposed new technology of construction and installation of technological equipment has been agreed upon with Soviet design and planning organizations and adopted for experimental verification, which will be followed up by a subsequent analysis of the attained results jointly with Soviet specialists.

8204
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INTERVIEW REVEALS RESEARCH RELATION TO PAKS POWER PLANT

Budapest MAGYAR TUDOMANY in Hungarian No 12, Dec 83 pp 918-924

[Interview with Ferenc Szabo (corresponding member of the Hungarian Academy of Sciences and director general of the Central Physics Research Institute), Zoltan Gyimesi (director of the Central Physics Research Institute's Atomic Energy Research Institute) and Jozsef Ponya (director general of the Paks Nuclear Power Plant Enterprise), by Gabor Pal Peto: "From Csilleberc to Paks"; date and place of interview not given]

> [Text] The startup of the Paks nuclear power plant's first generating unit is an important milestone in the history of both electric power generation and research into nuclear power generation in Hungary. So far as electric power generation is concerned, the following fact is very meaningful: by the time the interview published below took place, the Paks Nuclear Power Plant Enterprise had already supplied a billion kilowatt-hours of electricity to the national power grid and had just completed successfully its 72-hour trial operation. Concerning research, from an operating reactor of a power plant it obtains during operation a quantity of data whose analysis can serve as the basis of many new research results.
>
> At the end of a stage that is more or less over, which of course also means the start of a new stage, let us ask two of the key figures in the research that preceded the Paks nuclear power plant's construction, and also the man in charge of the nuclear power plant's operation, to look back on the work during this long and fruitful period. The persons we interviewed were: Ferenc Szabo, a corresponding member of the MTA [Hungarian Academy of Sciences] and director general of KFKI [Central Physics Research Institute]; Zoltan Gyimesi, director of the AEKI [Atomic Energy Research Institute of the KFKI]; and Jozsef Ponya, director general of the Paks Nuclear Power Plan Enterprise (Paksi Atomeromu Vallalat).

[Question] Research into atomic energy, and within it particularly into reactor physics, began in Hungary--specifically at the KFKI-- nearly a quarter

century before the startup of the first generating unit at the Paks nuclear power plant. What type of work was being done during this lengthy period, and what was its purpose?

Ferenc Szabo: Research into nuclear reactors is applied research in principle. It cannot be called basic research, for the subject of its investigation does not belong in the exploration of nature. Man and not nature builds nuclear reactors. But this applied research may want to gain a deeper and finer insight into the operation of reactors, and it may be goal-oriented research that ends in or flows into the realm of practice. The research that we conducted here from the early 1960's on was research to explore the operation of nuclear reactors. Very simply stated, we investigated what makes a nuclear reactor work. For this is not something quite so simple and obvious. The Soviet colleagues who were our consultants at that time were entirely right when they said that we would never really understand these processes, unless we too investigated them. You have to do things of this kind before you really begin to understand them.

Experimentation began in 1960, specifically with measurement on zero-power reactors.* We used the results of these measurements on the KFKI research reactor, and on the teaching reactor at Budapest Technical University (Budapesti Muszaki Egyetem). We already had experience with building, and conducting measurements on, five critical assemblies when in 1972 we formed, jointly with the other European socialist countries, the Provisional International Collective (Ideiglenes Nemnzetkozi Kollektiva) which subsequently also Cuba, Vietnam and Finland joined. The KFKI became the center of this collective, in spite of the fact that Hungary, regrettably, had just delayed construction of the Paks nuclear power plant. The ZR-6 zero-power reactor became the collective's main experimental installation, but subsequently the research base was enlarged with the addition of an experimental nuclear power plant in Rheinsberg in the German Democratic Republic, and of a critical assembly in Czechoslovakia (the one in Rez). During 11 years, within the framework of the collective, 155 foreign researchers put in 500 man-months; and 28 Hungarian researchers, 650 man-months. The results of their work are contained in 212 research reports. They investigated 190 zone configurations.

Here I must mention another important event. In the mid-1960's, a staff member of the Obninsk [Physics and Power Engineering] Institute who had visited us on many occasions before--to participate in our work and debates, to hold lectures and to do consulting--drew up a "menu" or list of the research topics on which we could have cooperated. But when we were just about to sign a contract, two of my collaborators, still young at that time, said that all those topics were interesting and they would like very much to do them, but were we to undertake them all, we would not have any time and energy left for anything else. Yet we had to bear in mind that a nuclear power plant would be built sooner or later also in Hungary, and we would have to cooperate on that work as well. Therefore they proposed that we accept only a third of the "menu" and devote the rest of our time to preparing research for solving the problems of a power reactor. I was very pleased with this spontaneous initiative. In other words,

*A zero-power reactor is one whose power level is so low (10 W at most) that it may be regarded as zero. Also known as a critical assembly.

with the fact that my collaborators (at that time Ferenc Szabo was director of the AEKI.--Editor) themselves chose what I would call a mission-oriented style of research, instead of very interesting research but aimed only at curiosities. This is the element that I regard as decisive: the nuclear power plant, nowhere as yet at that time, had such a strong influence on research!

This is how the journey from Csilleberc to Paks began. The concept evolved that subsequently characterized the work of this entire division. In other words, the participants accepted the drawbacks and difficulties, the prospect that it might not be possible to publish the results, that they would not appear in the professional literature and the Citation Index, only in practice.

Zoltan Gyimesi: There were three fortunate elements of the research in this stage. First, that in Hungary--primarily within the Academy of Sciences--the principle was accepted fairly early that such research was necessary. And not only was this principle accepted, but the research also received support, both moral and financial. This decision showed long-range foresight, something that --let us admit frankly--does not happen always and everywhere. The second such element was that our international contacts were very good. We cooperated closely with institutes in the Soviet Union, Czechoslovakia and the German Democratic Republic, including institutes that were the first ones to undertake the development of reactors. This cooperation has been very good from the very early stage of the research related to the Paks nuclear power plant. Finally, as the third element I would single out the fact that the present representatives of nuclear power generation in Hungary, primarily Paks, require our assistance and are relying on us.

In preparing for the problems of nuclear power generation in Hungary, our "philosophy" was to choose first of all the special areas that fitted into the nature of the KFKI: reactor physics, thermodynamics, diagnostics, radiation protection, and the water-chemistry problems of nuclear reactors. In other words, we are not researching everything but are concentrating our manpower and resources on a few areas. Another decision of fundamental importance was to concentrate not on the design and construction of reactors, because we knew this was a field in which we would be relying basically on imported know-how, but on the problems of operation and safety, an area which eventually would be a Hungarian responsibility.

Ferenc Szabo: In the stage preceding the construction of the nuclear power plant in Paks, then, research focused on how to accurately calculate the operation of a nuclear reactor, build suitable models, and simulate the processes. At that time nowhere in the world did they know how to accurately simulate nuclear power plants, the power reactors that were already in operation at many places. Even in the professional literature one found reports, specifically from the United States, of discrepancies amounting to 50 percent between certain calculated and measured values. This was due partially to the fact that the computers then available had a rather limited capacity, and it was possible to construct only models that the computers were able to accomodate. Moreover, we knew some of the basic nuclear constants only with limited accuracy, and suitably refined measuring methods were lacking. Therefore our physicists set as their objective the construction of a more accurate model. But there remained, of course, the big question of what was accurate. For although in

principle we must strive for the greatest possible degree of accuracy, there obviously is an optimum somewhere that is not worth exceeding. But where this optimum lies was clarified only in the second half of the 1970's. Incidentally, computations to answer this question are still in progress at the KFKI even today, but they are no longer reactor-specific.

At that time Lajos Janossy, the director of the KFKI, wrote an extensive book of fundamental importance on measurements and measuring errors. In organizing international cooperation, this book served as a guideline for the technology of scientific work. For the members of the collective, coming from different countries, brought with them their own domestic practices. It required considerable effort to convince everyone that the data of the primary measurements had to be filed in a standardized, uniform manner so that they could be retrieved at any time. The next and even more difficult step--and this is where Janossy's book played a decisive role--was to fit curves to the measured points by some mathematical method. This method had to be a truly mathematical one and standardized, otherwise the results measured by individual researchers would not have been mutually comparable. As the basis for this we used Janossy's book that discusses the theoretical problems of the mathematical and statistical processing of measured data. Janossy's book was an outstanding work, but computers began to be used extensively in this field essentially only after it was written. Therefore the book had to be developed further, and only then could it become a generally available contribution to practice.

Jozsef Ponya: This is the scientific background with which the construction of the Paks nuclear power plant began. I would like to emphasize that in the course of construction and startup we cooperated with an entire series of Hungarian research institutes, too long even to list: the VEIKI [Electric Power Industry Research Institute], the Iron Industry Research Institute (Vasipari Kutato Intezet), the Joliot Curie Radiation Biology Institute (Joliot Curie Sugarbiologiai Intezet), Budapest Technical University, the Isotope Institute (Izotop Intezet), the MAFKI [presumably misprint for MFKI, Institute of Applied Physics], Veszprem Chemical Industry University (Veszpremi Vegyipari Egyetem), and the ATOMKI [Nuclear Research Institute]. My apologies if I omitted anyone. But the support of KFKI's Atomic Energy Research Institute was crucial. When the Soviet partner supplied the first technological plans, the 12-volume planning package and specifications that the appropriate--public health, environmental protection, etc.--Hungarian authorities had to approve, the experts at the KFKI were the first ones we called for assistance. We knew that on the research reactors they already had experience in this field. They studied the plans for several months and then asked numerous questions, which were answered by Soviet experts who visited us for that purpose. They went through every question and debated them in detail. This took two full weeks.

From then on through startup, and even thereafter to this day, the experts of the KFKI's Atomic Energy Research Institute have stood at our side and have supported us, and not simply with studies and theoretical expositions, but in practice, utilizing the practical experience they gained over many years. From the very first moment we felt that these people had not worked and studied in vain in this field for many years and knew their tasks. They participated in every exchange of views and debate, for let us admit that there naturally were debates as well. There remained open questions even after such debates.

For this reason we invited also the personnel of the KFKI's Atomic Energy Research Institute to the negotiations, whether they were held in Budapest or in Moscow.

[Question] With this we have shifted, almost unnoticeably, from the history of research at the KFKI to the history of the construction of the Paks nuclear power plant's reactor. I believe that this almost unnoticeable transition is not accidental but outright typical.

Jozsef Ponya: That is correct. Moreover, when we signed the technological plan and work began on planning construction, we included the staff members of the KFKI in this work as well, despite the fact that these were technological and not scientific problems. The constant exchange of view nevertheless continued. If in the course of construction we did not understand something, we asked the KFKI. For example, what wall thickness was suitable, how much radiation would it let through, etc. And when deliveries of the installations began, we again received advice from the KFKI on which were the insignificant partial questions not worth disputing, and which were the ones we really had to look out for.

Zoltan Gyimesi: Of outstanding importance within the work we performed at that time were, in my opinion, our computation on biological protection. At the request of the EROTERV [Enterprise for the Designing of Electric Power Plants], we recalculated the volume weight of the protective concrete specified by the Soviet designers. Domestic industry would have been able to make this concrete only with imported aggregate. We proved that concrete made with the customary domestic aggregate would provide adequate biological protection. The Soviet designers accepted our results, and in the startup phase these results were proven correct. Thereby it has been possible to achieve savings of the order of one hundred million forints.

In 1975, we were commissioned to design and build the complete area monitoring system for the Paks nuclear power plant. The model for this was the area monitoring system at the KFKI that had been in operation for a long time and was being perfected constantly. We developed the measuring and evaluation procedures, and once we designed and built the entire system--the on-line and off-line stations, the sample-measuring laboratory, and the truck-mounted mobile laboratory--we trained the Paks personnel. Later we developed the continuous sampling system for the three water-monitoring stations, the equipment for continuously measuring the activity of the water in the cold- and hot-water lines. The measured values are fed into the area monitoring system's date acquisition device. We also designed the equipment for continuously measuring the radioactive iodine content of the released air. With this the area monitoring system of the Paks nuclear power plant attained a level that has become the goal worldwide only since the Three Mile Island accident.

Ferenc Szabo: The radiation protection system comprises 7 active and 14 passive stations. Besides the mobile laboratory, the system includes also a meteorological tower. The development of instruments and methods, and the theoretical investigations in the field of radiation protection are directed toward research into personnel dosimetry and area monitoring. In this many-sided activity I would single out the development of the luminescent dosimeter that is being used at our institute and in Paks. It has also been used aboard the

Salyut spacecraft to measure the radiation exposure of the astronauts, among them Bertalan Farkas.

Jozsef Ponya: Research institutes, in my experience, are reluctant to repeat anything. Yet the KFKI was willing to repeat, to develop and install the area monitoring system, and to train our personnel. Even today its staff members come down to Paks now and then. The automatic area monitoring system that they designed and built is now unique in the socialist countries.

[Question] Would it not have been simpler if, instead of training the Paks personnel, the KFKI experts--and here I do not have only the area monitoring experts in mind--had transferred to Paks?

Ferenc Szabo: The first, reflexlike, response was to do just that. Every work begins with assembling the cadres who then hire and train the others. Here, too, this was the first idea: the KFKI personnel knows this, so let the KFKI provide the cadres. At that time I definitely said, No. For had we provided cadres, the outcome would have been an incomplete team, both here and there. I proposed that Paks should hire people with basic training, e.i., graduates of the Moscow Power Engineering Institute, and we--as agreed with Benjamin Szabo, the government commissioner in charge of the nuclear power plant project--would accept them for professional training and experience, here at the institute. This was done very flexibly: the personnel remained on the Paks payroll but came to us on temporary assignment. Everyone was assigned to a team whose work was closely linked to the individual's own work. Some of them worked here a month or two, others perhaps for years. And then they went back. To my knowledge, for those of them--the operators, for example--who had to complete a course in the Soviet Union, this training proved useful, and they passed their examination with good grades. In terms of volume, this training was the equivalent of 25 man-years.

Zoltan Gyimesi: Also in this manner the relationship between Csilleberc and Paks became a personal one, more and better than official contact.

[Question] In addition to reviewing the system of radiation protection, and to installing--as prime contractor--the measuring and control system for area monitoring, there probably have been many reactor physics, operation, accident prevention and computing problems that the KFKI has helped to solve.

Ferenc Szabo: All these problems could perhaps be listed only in a book. I will mention a few merely as examples. Of fundamental importance were our research into reactor physics, as I have indicated in conjunction with the Provisional International Collective. We tested on the ZR-6 critical assembly the models for reactor physics calculations. We took over from the Kurchatov Institute in the Soviet Union the BIPR program that is the basis for zone physics computations, adapted it to the R-40 computer with the help of Soviet experts, borrowed the improvements of the algorithm from Bulgarian colleagues, made data handling easier, debugged the BIPR-5 program, and prepared the start-up calculations for the reactor's first charge.

Jozsef Ponya: I must say that the KFKI enjoys an exceptional reputation at the Kurchatov Institute. This institute itself proposed that it would not send its

own experts to Hungary to supervise trial operation if the KFKI would undertake the reactor physics work. This is a great thing because it means that responsibility for a Soviet product is being assigned to experts of another country.

Zoltan Gyimesi: We should mention under cooperation in reactor physics also the system for the computerized acquisition and real-time evaluation of data on the physical measurements necessary during startup and operation. We developed this system from 1974 to 1979 and tested it under operating conditions in March of 1980, in Bohunice (Czechoslovakia) and Kozloduy (Bulgaria).

Ferenc Szabo: We conducted also research into thermohydraulics. Here the primary consideration was to improve safety. The main result of this research under Soviet-Hungarian cooperation is the set of programs necessary for safety analyses.

[Question] Obviously a complicated and dangerous installation such as a nuclear reactor cannot be entrusted solely to human operators. Many things have to be automated or controlled by computer. What work has the KFKI done in this field in the course of the Paks nuclear power plant's construction?

Zoltan Gyimesi: In addition to consulting and giving expert opinions, our most important contribution was that we developed an entire series of new solutions to bridge the problems that arose with the generating unit's computer. This included the development, within a very short time, of a file-management system for data on breakdowns, the development and installation in Paks of a 200-channel data-acquisition computer for measurement data, and the dynamic modeling of the primary loop at the Paks nuclear power plant.

Ferenc Szabo: It likewise belongs in the field of computer technology that, in cooperation with the VEIKI, we developed and installed in the reactor a system of reactor diagnostics. Without sounding immodest, I may say that the research which the staff members of AEKI did in the now classical field of the stochastic properties of neutron processes established a new scientific school. The investigation of equipment noise, which plays an ever-greater role in diagnostics in general and not only in reactor diagnostics, was based on the results of this research. Here research into reactor physics is obviously connected to research into thermodynamics.

Jozsef Ponya: When work began on starting up the reactor, we discovered very many minor phenomena that could be characterized as gaps in the system. We again turned to the Hungarian researchers, and it turned out that in certain partial areas Hungarian research was far ahead of research in other countries. They were able to answer our questions, and in some instances they offered on their own initiative proposals on how we should do certain things. For example, how to measure more accurately. They developed the instruments and methods for this purpose. In some areas, of course, the Soviet supplier provided only the final results. But we wanted to know how they obtained these final results, what was their starting point, and why specifically the given values. This happened, for example, in the case of the safety-analysis calculations. Staff members of the KFKI calculated these data because they would be necessary should we decide to make certain changes.

[Question] Regrettably or perhaps fortunately, we could continue endlessly this listing of examples of cooperation between domestic researchers on the one hand, and the experts in industry and in the planning, construction and operation of the nuclear power plant on the other hand. But space limitations do not allow us to do so. As my last question, may I request you to sum up your experiences or rather your views to date, and at the same time to take a glance also into the future.

Ferenc Szabo: The process by which science becomes a productive force is neither simple nor easy. There were, of course, frictions and differences of opinion also between Csilleberc and Paks. They stemmed from the fact that the viewpoint of the expert at the plant is different from that of the researcher. On basic issues--for example, on whether the cooperation of science is necessary in establishing and operating a nuclear power plant--there has never been any difference of opinion. Both places managed, or attempted to manage, so that work would proceed in harmony, and we strived to form the behavior of the people accordingly. I believe we have succeeded in doing so, and this I regard as a result of outstanding importance.

Jozsef Ponya: We in industry were at first pleasantly surprised that the KFKI undertook all work with specific responsibility. In other words, to our question as to whether they accepted responsibility for what they recommended, their answer was in the affirmative. Regrettably, there are quite a few research institute collectives (by which I do not mean entire institutes) that are unwilling to accept responsibility when we ask them to do something very specific. We were greatly impressed by the fact that the KFKI--and most of our other cooperating partners as well, but here we are talking only about relations with Csilleberc, are we not--not only wrote studies but also stood there at the site, and did so with responsibility. We frequently came to the conclusion that these people knew what they were doing and therefore dared to accept responsibility for it. The fruits have now become tangible that they produced through long years of work on research reactors: their experience and know-how, the value of which is difficult to express in money terms. On the other hand, they too must have profited much from their participation in the work at Paks. Here they encountered under industrial conditions for the first time what they had been researching, and here they gained a large volume of data that they could use as feedback in their research. Here they are able to observe and investigate on a full scale the processes of reactor physics, thermohydraulics, etc. This reciprocity is a great advantage and is of great mutual interest. Therefore KFKI staff members are constantly present in Paks, doing so much work of such quality that cannot be obtained either on command or for money.

And if we look into the future, we see many tasks the need for whose solution has only now become apparent. For example, we are seriously investigating the feasibility of increasing reactor performance. Today we already have a significant volume of data which prove that we are treating too cautiously certain production-limiting factors, and that it might be possible to increase the output of the 440-MW generating unit. This could represent huge amounts even if the improvement is of the order of a tenth of one percent.

Further research related to the operation of the nuclear power plant is in progress. For example, we have developed a system for analyzing errors. But also

important is our work, in cooperation with the KFKI, to computerize the operating instructions. These instructions cover several thousand pages, which is practically unmanageable. But the desired section can be recalled quickly from the computer's memory. Similarly, a computerized system could play an important role in passing on information between groups of operators relieving each other: the cross section containing the most important operating data can be displayed on the screen.

Zoltan Gyimesi: Most of the tasks in conjunction with the nuclear power plant's operation concern the refinement and further perfection of the operating methods. This is known as the optimization of the operating methods. For example, it is necessary to check the reactor's schedule, whether the forecast changes in the active zone were correct, when the individual fuel elements burned up, which rod was moved where, etc. This is again proceeding within the framework of international cooperation. The so-called Hindu Kush internal control and monitoring system measures the reactor's various--neutron-physical, thermodynamic--data; on it is based our system that evaluates the data of the detectors, for possible corrections. This Verona system is being developed in cooperation with the Kurchatov Institute, the ERBE [Power Plant Investment Enterprise], and Paks.

Most of the finer measurements and calculations that are being performed in cooperation with Soviet experts apply not to the 440-MW generating unit in Paks, but to the 1000-MW type. At the same time this research is important for Paks as well, because it is continuing to develop further: the Nos 5 and 6 generating units will be 1000-MW ones. This work sets stricter requirements for us, but the application of its results will advance also the computation and evaluation systems of the 440-MW generating units and will probably offer economic advantages for them as well. This is how the present becomes intertwined with the future.

[Question] Thank you for the interview.

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CSO: 5100/3007

NUCLEAR POWER DEVELOPMENTS DESCRIBED

New Power Plant Construction

Warsaw TRYBUNA LUDU in Polish 7-8 Jan 84 p 1

/Article by zw: "At the Zarnowiec Nuclear Power Plant Construction Site"/

/Text/ (Own information) Construction of the first Polish nuclear power plant is continuing at Zarnowiec Lake in the northern part of Gdansk Province.

Extensive excavation work is being conducted at the large construction site. Nearly 3 million cubic meters of soil have been moved. The ground beneath the generator building and the central pumping station has been specially reinforced in accordance with technical specifications and a deep drainage network has been laid out.

The first permanent buildings, such as the central boiler room and the administrative building with a cafeteria and locker rooms for the ever-increasing construction crew, have been erected. The footings will soon be built for the Soivet-made WWER-440 water-cooled reactor.

The village of Kartoszyno is disappearing from the map. Its inhabitants are being moved to new farms in Odargowo constructed with the Zarnowiec plant's funds. Housing and hotel facilities for employees of the firms building the nuclear plant are being built in Reda, Wejherowo and Gniewino.

The railway line from Wejherowo to Zarnowiec is also being modernized. The line is being electrified and the railbeds and tracks are being reinforced. The plant's power equipment and other machinery will be brought in over this railway line.

Nuclear Research, Development

Warsaw PRZEGLAD TECHNICZNY in Polish 31 Jul 83 p 32

/Article by Grzegorz Borowinski: "Ewa Is 25 Years Old"/

/Text/ Polish research in the area of nuclear reactor physics, radioactive chemistry, materials properties and nuclear power engineering began with Ewa.

Ewa, the first Polish nuclear reactor, was bought in the Soviet Union and became operative in 1958. This was the beginning of a great scientific endeavor at the Atomic Research Institute in Siewerek. Without a reactor of this sort, it was impossible to conduct the studies mentioned above or to create radioactive preparations and closed radioactive sources so universally used in modern medicine, biology, agriculture and industry.

Ewa, the experimental water-cooled reactor, uses enriched uranium for fuel. The reactor's moderator and reflector is normal water with traces of beryllium, and the coolant is water. Ewa is in a ferroconcrete housing which also serves as a radiation shield for operating personnel. The reactor's actual output is 8 MW. The initial output of 2 MW was gradually increased to this figure by Polish specialists.

Ewa has been a good mother for Polish nuclear science. She has taught us much and work on a grand scale has progressed in bold steps. In 1974, the second Polish reactor, Maria (named in memory of Maria Sklodowska-Curie), reached critical mass. Maria's nominal output is 30 MW with an optimal output of 60 MW. Maria's fuel is enriched uranium with a beryllium moderator and water coolant. Maria is a general-purpose reactor. This means that she can be used for materials research and production of isotopes.

Ewa and later Maria made it possible to develop and introduce much new technology for the production and use of radioactive nucleides or isotopes. The unquestioned success of the Atomic Research Institute has been its mastery of producing closed radioactive sources and industrial radioactive preparations. These have been used for purposes such as flaw-testing, automating technological processes and the production of smoke detectors. The isotopes produced include iridium-192, cobalt-60, strontium-90 and plutonium-239. Different, some of them original, isotope technology devices have been constructed in Poland. They include meters for weight and thickness from 0.001 to 50 mm, thickness meters for cold-rolled sheet metal that are accurate to 0.3 percent and can also be used for measuring fluid viscosity in industrial process lines. These nuclear technology devices are used not only in domestic chemical, petrochemical and metallurgical industry equipment but have also received praise abroad.

Isotopes for Brain Research

Radioisotopes are especially important for medicine and biology. The Atomic Research Institute has developed technologies for producing sterile generators of ind-113m and technet-99m as well as several sets of isotopes clinically applicable in "in vivo" medical diagnostics for studying brain activity, the kidneys, lungs and the liver. In physiological and medical research, compounds (radioisotopes) are added to food or medicine or simply injected. They are observed and their accumulation, conversion and elimination can be studied. Medicine now knows and uses hundreds of different methods for using isotopes. The Institute's research work on isotopes used for hormone and protein radio-immunology has also been very important. It is worth adding that the Atomic Research Center produces sets for designating insulins, the human growth hormone, triiodtyronines and gonadotropines. All of this work began with Ewa, but it was only the construction of the reactor Maria that made it possible to set up

a Polish-Soviet program for materials research that has significantly advanced the program for building high-temperature reactors cooled by disassociating gases.

The Atomic Research Institute in Swierek was for many years the largest scientific research facility in Poland. The center participates in an integrated program of research on nuclear power engineering. Both Ewa and Maria became test units. Under the PR-8 Government Research and Development Program (comprehensive development of the power industry), it will be necessary to build spent fuel storage dumps and modernize auxiliary facilities and experimental systems for the Maria reactor by 1985. Meanwhile, in 1990-1995, Maria's output will be increased to 60 MW and her basic system will be modernized.

The PR-8 Government Program also plans increased work on the technology for extracting uranium from domestic ores and from nonconventional materials and the construction of equipment and technology for the "hot" part of the spent fuel conversion process. Of course, the degree to which the nation's uranium needs are covered largely depends upon geological prospecting. Studies have shown that it is possible to obtain as much as 200 tons of uranium annually from phosphoric acid. Reprocessing spent fuel can also lower fuel costs for nuclear power reactors by about 20 percent. All of the above research is very important for our national economy.

On the other hand, prospective research on using high-temperature nuclear reactors as a technological heat source was limited in the years 1981-1985 to development of a program of work, investments and analysis of needs. A report by the Polish Academy of Sciences on the state of the power industry in the past year did, however, stress that high-temperature reactors are a necessity for the rational development of organic chemistry. It turns out that the future of coal use will be determined above all by progress in nuclear power.

The Atomic Research Institute has many accomplishments, above all in the realm of theory. The institute's researchers have worked out control and measurement systems for pressurized water reactors and select apparatus. Much attention has also been given the development of first-cycle equipment in nuclear power plants as an export product. Within an international allotment of tasks, the Atomic Research Institute has also been involved with work connected with sodium-cooled breeder reactors. A few years ago, research was started on a new and unconventional type of fast neutron power-generating reactor cooled by disassociating gas. This research was conducted jointly with the Nuclear Power Institute of the Byelorussian Academy of Sciences in Minsk.

Of course, one must be aware of the fact that a nation as economically developed as Poland may not conduct on its own resources even half of the research necessary to fill the technological gap in nuclear science. Joint research work within the Council for Economic Mutual Assistance has made it possible considerably to reduce the costs for every state. Ewa is an example of such cooperation and assistance by Soviet technology and science.

Polon Nuclear Equipment Plant

Zielona Gora GAZETA LUBUSKA in Polish 11 Aug 83 p 1

/Article by Frab.: "Contractors Satisfied with Polon"/

/Text/ The representative of the Soviet Atomenergoeksport Foreign Trade Center, Vladimir Korneev, recently visited the Polon Nuclear Power Equipment Plant in Zielona Gora. During the visit, he saw how the production of Sejwal equipment was proceeding.

The Sejwal system consists of 32 interacting electrical devices. This is a system used at nuclear power plants for measuring and recording radioactive contamination. It contains such equipment as radiation detectors, data gathering and processing equipment that informs personnel about contamination levels, and portable equipment for measuring contamination of personnel, clothing and vehicles. All of the electronic equipment is highly sophisticated.

Long-term failure-free performance is required of the equipment of the Sejwal system. Other than the above, the system also includes safety equipment for preventing plant malfunctions.

Equipment manufactured by the Polon plant in Zielona Gora will be used at nuclear power plants being constructed in member countries of the Council of Economic Mutual Assistance /CEMA/.

The Atomenergoeksport representative expressed his great satisfaction with the pace and quality of the work on the contract started in December 1982. Five Sejwal systems are to be manufactured for this contract. Two are already under production.

Interatominstrument Service Enterprise

Zielona Gora GAZETA LUBUSKA in Polish 10 Aug 83 p 7

/Article by K.L.: "At the Nuclear Power Equipment Plant"/

/Text/ Interatominstrument in Zielona Gora is Poland's only nuclear power equipment service enterprise. It has divisions in Krakow and Warsaw and is a member of the International Economic Association of Nuclear Power Equipment.

Interatominstrument services nuclear power equipment manufactured in Poland, the German Democratic Republic, the Soviet Union, Czechoslovakia, Bulgaria and Hungary. This includes medical equipment, scintillographs and scintillogram charts, scientific equipment such as spectrum analyzers for chemistry and physics laboratories, and dosimetry equipment.

Parts and component assemblies needed for service work are provided by the equipment manufacturers. The service department repairs equipment and the assembly plant installs and maintains fire detectors, isotope thickness gauges and electric charge neutralizers.

Interatominstrument employs about 45 workers. There is little space for them in the small building on Sikorski Street but a new building is being constructed for the firm on Energetykow Street.

The move to the new building is scheduled for this year, and this will enable the enterprise to expand its services. The specialists at Zielona Gora will then also be able to begin designing and producing equipment for this newest technology.

New Interatominstrument Service Facilities

Zielona Gora GAZETA LUBUSKA in Polish 4 Nov 83 pp 1, 2

/Article by sz: "New Facilities for Interatominstrument"/

/Text/ The Interatominstrument Equipment Service Plant held opening ceremonies at its modern new facilities on Batory Street in Zielona Gora yesterday. The ribbon for the new plant was cut by Col Walerian Mikolajczak, who said that the location in Zielona Gora of these facilities, along with such plants as Lumel, Polon and Unitra, is an important element of the new branch of the nuclear power and electronics industries. He also emphasized the pace and quality of investments that have been made over the past 2 years and 5 months by firms such as Budimex and Budopol in Poznan for widespread peaceful use of atomic energy and equipment by the member nations of the Council for Economic Mutual Assistance.

The chief director of Interatominstrument, Zbigniew Twardon, spoke about the decision of the CEMA Executive Council to begin production and service of atomic power equipment presently new to the CEMA member nations. The construction and expansion of the Zielona Gora Interatominstrument plant is the result of this decision.

The plant's service director, Aleksander Sipowicz, informed those present that the plant will begin operating in its new quarters this month. The new facilities will continue providing production and service into the next century. The entire complex was built to meet this goal.

The following persons were present at the ceremonial opening of the new facilities: secretary of the PZPR provincial committee, Roman Czolhan; first secretary of the PZPR city committee, Stanislaw Gorny; director of the International Investment Bank in Moscow, Zbigniew Maszczyk representatives of Budimex, Budopol, Metrimpex, Lumel, Polon, Unitra and other Zielona Gora plants, the Higher School of Engineering, and the construction crew as well as the staff of Interatominstrument.

During the tour of the new plant, much recognition was given to the workers who built the plant. The crew was still on the site and heard the high opinions expressed about their work.

Installation of Training Reactor

Krakow ECHO KRAKOWA in Polish 21 Sep 83 p 1

/Article by MN: "Krakow Will Have a Nuclear Reactor!"/

/Text/ In June we reported the problems of the Institute of Physics and Technology of the Academy of Mining and Metallurgy, which wanted to build a UR-100 nuclear reactor for teaching purposes. The reactor was ready but since the building that was supposed to house it was "dropped from the plan," the reactor had to be stored until a building could be located.

Quarters for the new reactor have now become available. We have learned from the Ministry of Science, Higher Education and Technology that on 29 July this year the decision was made to begin the reactor's installation. It will be housed in an addition to be added to the didactics building of the Institute of Physics on Kawiora and Miechowska Streets. The Institute is supposed to complete construction of the new wing by 1985.

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UN CONSULTANT ADVOCATES N-ENERGY FOR BANGLADESH

Dhaka THE BANGLADESH OBSERVER in English 20 Jan 84 pp 1, 12

[Text]

I.H Usmani, a senior consultant, United Nations (UN) Technical Assistance said in Dhaka on Thursday that nuclear energy and the renewable sources like solar radiation biomass and the hydroelectricity were the only alternative to meet the future energy demand of Bangladesh.

In an exclusive interview with BSS Dr Usmani said that with the establishment of a national power grid through the East-West Interconnector, the prospect for a nuclear power station as a reliable and cheaper source of power in Bangladesh had become more feasible and brighter than ever.

He said that though there was a large reserve of natural gas in the country this valuable resource, should be conserved for manufacturing fertilizer, petrochemical products and for using as compressed gas in running the railway locomotives steamers and the motor launches, where large cylinders can be used, otherwise, he said the entire reserve is likely to dry up at the beginning of the next century.

He said that in the future power generation system of Bangladesh the national grid should be fed with the bigger sources of power like nuclear energy and hydro-electricity in addition to the gas fired stations, and this should be utilised mainly for meeting the electricity demand of the industries and of the urban areas.

Talking about the rural energy needs Dr. Usmani said that in his opinion Bangladesh is ideally suited for rural electrification on village-to-village basis through solar cells which can be cheap and commercially competitive if produced on a large scale.

He suggested establishment of demonstration centre for solar energy utilisation financed by the United Nations so that the local scientists as well as the consumers can gain experience out of it.

Dr. Usmani, a former chairman of Pakistan Atomic Energy Commission said "I personally believe establishment of a nuclear power plant with a capacity of 600 mg. to 800 megawatt is possible in Bangladesh provided the government have a firm decision".

Bangladesh has signed the nuclear non-proliferation treaty in September, 1979 and the international safeguards regulations in June 1982 with the International Atomic Energy Agency (IAEA) a specialised agency of the United Nations.

Dr Usmani said that the proposed nuclear power plant at Rooppur should have two reactors each with a capacity of 300 mw to 400 megawatts. Any plant smaller than this will not be commercially competitive he said.

CSO: 5100/7052

BRIEFS

JAPANESE NUCLEAR EXPERTS--A three-member mission of nuclear experts from Japan led by Mr Ichiro Yagi met Dr Anwar Hossain, Chairman, Bangladesh Atomic Energy Commission (BAEC) on Monday, says a Press release. During discussion, the mission showed much interest in co-operating with BAEC in implementing various R&D project utilising the research reactor, now under installation at AERE, Savar. The mission was also impressed by the programme of BAEC in the field of food preservation by radiation and offered technical collaboration in its commercial utilisation. Later the mission visited the Laboratories of Institutes of Atomic Energy Research Establishment (AERE) at Savar. The mission expressed hope that joint collaboration between BAEC and nuclear research facilities of Japan will be intensified in the near future with an aim to increase the role of nuclear radiation in economic development of the country. [Text] [Dhaka THE BANGLADESH TIMES in English 31 Jan 84 p 3]

CSO: 5100/7053

PRIVATE AID TO NUCLEAR POWER PLANTS TO BE DISCUSSED

Bombay THE TIMES OF INDIA in English 19 Jan 84 p 12

[Text] NEW DELHI, January 18. DIRECTIONS on industry's backup to the nuclear power programme in the next two decades will come for discussion at a meeting being convened next month in Madras by the chairman of Atomic Energy Commission, Dr. Raja Ramanna.

The exercise is being undertaken in the hope that private units would be able to share production responsibilities in a programme for generation of 10,000 MW of nuclear power by the end of the century.

It is envisaged that some 5,000 MW of nuclear power will come from plants based on existing standardised design. The atomic energy department has initiated work on development of 500 MW unit design which may take about ten years.

The new programme presents a big opportunity for industrial units to get involved in an innovative hig-technology field. For the first time these units will be assured of repeated orders to justify their developmental costs.

Major Constraint

A major constraint in wider industrial participation in the atomic energy programme has been the small number of items required. Barring a few exceptions, most large and reputed industrial units remained didinterested while the challenge was taken up by some medium-sized enterprises.

The involvement of industrial units on large-scale is expected to cut down the time taken in completion of a nuclear power plant and it is hoped that a new atomic power plant will be completed in eight to ten years.

A wide range of capabilities exist in the country and the situation today is quite different from what it was in the sixties when the atomic power plan was initiated.

With the proposed expansion of the power generation programme there is some rethinking about the existing administrative structure. There is a proposal for reorganisation of the Atomic Energy Commission and revival of the Atomic Projects Authority.

The suggestion to set up a separate corporation for building and maintenance of atomic power projects has not been considered worthwhile since the project activity will continue to demand strong support from an interaction with the research and development wing. There has been some delay in appointing the director of the Bhaba Atomic Research Centre.

The Atomic Energy Commission may have, in addition to member for research and development, members in charge of power and industry. Industrial activity of the department has been increasing, and at some later stage the member, industry, could look after heavy water and fuel units.

The heavy water production programme has been geared up and there would be no problem of heavy water in two years. The Baroda plant has been producing for last four months about two tonnes a month. The Tuticorin plant is operating and the Kota plant is expected to start commercial production by April. The Taucher plant continues to pose problems but a new strategy is being considered to ensure that it gets requisite supply of inputs.

As for research and development, the new Nuclear Physics Centre near Indore will mainly concentrate on fusion research with the use of laser. The Physical Research Laboratory at Ahmedabad will continue to work on the Tokomak, a line in fusion research which has shown some promise abroad.

CSO: 5100/7054

BRIEFS

BARC SCIENTISTS' DEMAND--NEW DELHI, January 18: The Bhabha Atomic Research Centre Officers Association (BARCOA) has said the prestige of BARC has been "tarnished by its dismal performance, false claims of achievements, inspired leaks to the press and near-fratricidal warfare among factions" in the BARC. "The association is much concerned at the state of affairs," BARCOA's 1983 year-end report said, urging authorities to set up an official machinery for redress of grievances. BARCOA said engineers and scientists joining BARC feel frustrated because they are provided no work or "irrelevant or useless work." They have to live in an environment of perpetual insecurity and a state of constant fear or arbitrary authority, the association said. BARCOA which has forwarded eight suggestions to the BARC director for removing frustration has demanded freedon of expression to its scientists and engineers and decentralised decision making. BARCOA is the sole recognised body of BARC scientists and engineers. [Text] [Bombay THE TIMES OF INDIA in English 19 Jan 84 p 12]

CSO: 5100/7055

SCIENTIST AFFIRMS PAKISTAN CAPABLE OF URANIUM ENRICHMENT, WEAPONS PRODUCTION

Lahore NAWA-I-WAQT in Urdu 10 Feb 84 Magazine Supplement pp F1-F8

["Exclusive" interview with Dr Abdul Qadir Khan by NAWA-I-WAQT correspondent in Lahore on 9 February]

[Text] Question: You are the first Pakistani scientist to challenge the Western experts' monopoly on the enrichment of uranium. Is it because of this challenge that the people concerned in the West and their media have begun to slander you? Can you specify what country was working behind the scenes in this regard and still is despite the fact that the Netherlands Government granted you permission to work at the (Almelo) center after complete checks and appointed you a special adviser?

Abdul Qadir Khan: In fact, it was not only a challenge but it has destroyed the monopoly forever. By the grace of God, Pakistan is now among the few countries in the world that can efficiently enrich uranium. Whenever the Western countries think about us, they just imagine a few horse- and donkey-drawn carts. They could never envisage that a developing country like Pakistan would ever actually break the monopoly forever within a few years. The examples of India and Switzerland are before us. They were blackmailed by the imposition of restrictions on the enrichment of uranium and political advantages were reaped. As you know, this work is extemely difficult and its importance is paramount in the nuclear field. Progressive and affluent countries such as the Netherlands, Great Britain, and West Germany have spent the astronomical sum of $2 billion and have worked 20 years to set up a pilot plant through their joint efforts at (Almelo) in the Netherlands.

Similarly, a progressive country like Japan spent $650 million and managed to set up a small plant in 10 years. The United States is now setting up a centrifuge plant at Portsmouth, Ohio at a cost of $10 billion which will go into partial operation by 1988.

In light of the above facts, the Western countries could not even imagine that a poor and backward country like Paksitan could end this monopoly in so short a time. As soon as they realized that Pakistan had shattered their dreams, they fell on Pakistan and on me like hungry wolves and showered us with all the pejorative and derogatory terms in the world. Just consider for a moment the fact that they could not tolerate a Muslim country

becoming their equal in such an important field. Despite the president's repeated assurances that our nuclear program is for peaceful purposes only and for the production of electricity, these countries incited their media against Pakistan and myself.

Question: France has not honored its agreement to provide a reprocessing plant to Pakistan. Will Pakistan be able to successfully continue in the field of nuclear technology? When will Pakistan be able to utilize the nuclear power from the (Kahuta) plant at which work is being conducted for peaceful purposes? Pakistan now enjoys an outstanding position in the nuclear field and the Pakistani Government as well as the Pakistani people think Pakistan should be equal to other advanced countries in the use of nuclear power for peaceful purposes. Can you specify how long it will before the wish of the Pakistani people materializes?

Abdul Qadir Khan: As to the implementation of the agreement to provide a reprocessing plant, the attitude of the anti-Islamic Western countries, which they have against all developing countries in general, and the Muslim countries in particular is responsible, that is, no advanced technology should fall into our hands so that we will always remain at their mercy. They are all the same about this policy. We have no direct concern about the reprocessing plant and work is continuing under the supervision of the Pakistan Atomic Energy Commission [PAEC]. We are certain that if they work wholeheartedly and if the government provides the desired facilities, they will be able to do this work easily. You are deluding yourself if you think that the (Kahuta) plant is operating to enrich uranium. This uranium is being used to manufacture fuel for light water reactors. The Pakistani Government is trying to purchase a 900-megawatt reactor and negotiations are continuing with many countries for this purpose. It requires at least 10 years to obtain, install, and operate such a reactor. Because of this, we have at least 10 years to provide the requirements of our nuclear reactor. We are positive that when it begins operation, we will be able to provide it with fuel from our (Kahuta) plant. In this way, we will save ourselves the problems and helplessness that India is facing at present and we will also save on foreign exchange. The advantages of the work we are doing at the moment will become evident in a few years.

Question: As you well know, the Western press, led by U.S. newspapers, continue to drop hints about "an Islamic bomb." It is also a fact that Israeli capitalists are working behind the scenes. The government has said this is baseless. But despite these reassurances, sporadic propaganda continues. Would you like to comment on the reasons for this?

Abdul Qadir Khan: The "Islamic bomb" is a figment of the Zionist mind and this has been used with full force by the anti-Islamic Western countries. You must know that films have been made on the topic and books have been published, which are brimming with lies. All the Western countries are involved in this. Some to a greater and some to a lesser extent, but they all join the martyrs' camp by putting a little blood on their fingers. [Urdu proverb] I think that there is no other subject in

the world about which so many lies have been told as have the falsehoods which have been piled on us in this respect. The fact is, when we return from Western countries after completing studies there, we are amazed at the fact that such educated and cultured persons can stoop to such low acts. This persistent propaganda is aimed at creating fear in people and commercial organizations in Western countries so that if they sell anything to Pakistan it will appear again in the form of an Islamic bomb. therefore, they must not sell anything to Pakistan. They have been successful in this mischief-mongering to some extent and have imposed restrictions on the export of the most minor products.

By the grace of God, we are not dependent on them and we can manufacture such things in Pakistan ourselves according to our needs. In this regard, we must congratulate the scientists of the (Kahuta) plant and its engineers who have made Pakistan self-sufficient in this important job.

Question: Many countries, especially Canada and other European countries, are not nuclear powers. They have not manufactured bombs but they are far advanced in nuclear energy. How long will it take Pakistan to achieve this position? The above-mentioned countries provide nuclear technology to other countries and cooperate in supplying facilities to others, among which India heads the list. India conducted its first nuclear test in 1974 and, reportedly,it can do it again anytime. It has also acquired the ability to manufacture many atom bombs every year. But when Pakistan talks of peaceful uses of nuclear energy the same countries quickly begin propaganda against Pakistan. What is the reason for this contradictory behavior?

Abdul Qadir Khan: As I said before, all the Western countries including Israel are not only Pakistan's enemies but also enemies of Islam. If some other Muslim country had accomplished the same thing, the same venomous and false propaganda would have been conducted against it as well. The examples of Iraq and Libya are before you. Even though these countries are not capable of manufacturing an atom bomb for a long time yet Western media sources are conducting a violent propaganda campaign against them. In fact ,the Iraqi officer in charge of Iraq's nuclear program, Dr Yahya (al-Mashhadi, was killed ruthlessly in broad daylight in the famous Hotel Meridien in Paris while Iraq's nuclear reactor, which was being completed under supervision by an international body, was also destroyed.

All this is part of the crusades which the Christians and Jews had initiated against the Muslims 1000 years ago. Islam was the only religion which uprooted their culture and civilization and they have not forgotten it even today. The second reason is that all countries are aware that Muslims believe in monotheism and despite political disunity, they share each other's hardships. They are afraid that if Pakistan makes obvious progress in this field, then the whole Islamic world will stand to benefit. There is no such danger from India. You know that Iraq, Libya, and Iran had increased ties with India in the hope that India would assist them in nuclear technology but this was not the case and they were sorely disappointed. This is the reason why Western countries ignore India's nuclear program and its results and are after us.

Question: How can you compare Pakistan and India in the field of nuclear energy? India is far ahead of us. Can we catch up with India? How far ahead is India?

Abdul Qadir Khan: India was far ahead of us in the nuclear field. In fact, its nuclear program was based from the very beginning on sound foundations. The late Pandit Jawaharlal Nehru was at the head of this program and he used to take a lot of personal interest in it. Unfortunately, this did not happen in our country. When Dr Usmani, a very competent nuclear scientist with a Ph D in nuclear science, came, he set the nuclear program on a correct course. The nuclear powerplant at Nilor, "Pintech," and the Karachi powerplant "Kanupp," are the results of his efforts. He also got our scientists and engineers trained in the Western countries on very high and proper bases, and thus the base of our nuclear program was laid at a much later date than that of India. Now the Atomic Energy Commission staff is doing its best to fill the vacuum. As far as we are concerned, by the grace of God, we have left India far behind in enriching uranium and we are confident that India has so far made no headway in this respect. Such a big success in such a short time is the result of the personal interest and efforts of President General Mohammad Ziaul Haq. He not only encouraged our engineers and scientists, he also provided them with all the facilities which became the basis for this difficult task. I and my colleague are proud that we have placed Pakistan in a very enviable position in this field in the international level. If similar hard work is done in other fields with the same interest, then, God willing, we will reach the level of India in a very short time.

Question: Huge expenditure is needed in carrying out nuclear programs. Does Pakistan have enough financial resources to make satisfactory progress in this field and then use it in making up the shortfall in electric power, which we are facing now?

Abdul Qadir Khan: You are absolutely right that this job needs a huge amount of money. Unfortunately, our country has limited resources and it is on this account that we are dealing with our program in a gradual way. If we did not have this handicap we could have done this a long time ago and would have caught up with India. In any case, whatever has been done is praiseworthy, and the laurels of these achievements go to the present regime. I must make one thing absolutely clear: contrary to the mischevious foreign propaganda, no foreign country has given financial or technical aid to us in this field. Whatever achievement we have secured has been done by tightening our own belts. This achievement is the result of the untiring and selfless efforts of our scientists and engineers. Our technicians are not far behind foreign experts in any field. I am sure that, God willing, we will be able to make use of the atomic power within a few years. The Pakistan Atomic Energy Commission is doing all it can in this field and is busy in this regard. Most certainly, it will get satisfactory results in this field and will meet the electricity needs of the general public. As far as the supply of enriched uranium is concerned, we will supply the Atomic Energy Commission, God willing, with as much as it needs.

Question: We hear that the heavy water supply is very important in obtaining nuclear power, but nobody has mentioned anything about heavy water in Pakistan. Will this be imported or will some other process be used, which will not require heavy water? Has India set up four new heavy water factories?

Abdul Qadir Khan: Only the Karachi electric powerplant (Kanupp) needs heavy water and the Atomic Energy Commission keeps making necessary arrangements for this. As far as installation of a new reactor is concerned, the government has decided to use a light water reactor. No heavy water will be required by this reactor. As far as I think, as soon as the Kanupp runs its full life, we won't need heavy water at all. Even if we do need heavy water in the future, the scientists and other engineers will arrange for its supply.

Question: We have raw uranium in Pakistan. Is it processed in Pakistan or will we have to import processed uranium from abroad?

Abdul Qadir Khan: We have ample reserves of raw uranium in Pakistan and these are processed under the supervision of Atomic Energy Commission. The requirements of the Kahuta plant are met from the local supply.

Question: Pakistan is not much advanced in other sectors of science, particularly metallurgy and electronics. Are the computers required for the nuclear energy imported from abroad and are these things readily available in the world?

Abdul Qadir Khan: It is true that Pakistan is far behind in the field of electronics and metallurgy compared to the developed countries, but the conditions are not so hopeless that we could not make do with what we have. Although you do not see progress in offices and in the streets on the scale you see in the foreign developed countries, we are sufficiently expert in the items which we need for our jobs and, with the grace of God, our work is going ahead in a completely satisfactory manner and we are self-sufficient in several related branches. Since our needs are not limited, therefore, we have often to import items from abroad. Although Western countries do all they can to put obstacles in our way, somehow or other we do succeed in getting the required items. In the field of metallurgy, I have made enough progress on the international field and, in other sectors, our scientists and engineers have made considerable progress.

Question: In what sectors can nuclear energy be used, keeping in mind the circumstances which prevail in Pakistan?

Abdul Qadir Khan: As you know, the Atomic Energy Commission is using nuclear power in many sectors, for example, in electric power production, agriculture, medicine, medical treatment, and several other things. This circle may grow as the time passes.

Question: Will Pakistan be able to build a fast-breed reactor so that it can install its own electric power stations and, if so, how long will this take?

Abdul Qadir Khan: It is a very complicated technology; it needs much time, capital, and investment. Surely, the fast-breed reactor is considered to be the reactor of the future. If the Government of Pakistan makes a decision in this respect in time, then it would be a big challenge for Pakistani scientists and engineers and it is hoped that Pakistani scientists and engineers will accept this challenge. You must know that after 20 years of

joint efforts, France and India have now been able to install an experimental reactor in India. Western countries also have achieved only a limited success in this field.

Question: American press, like *NEWSWEEK, TIME, THE NEW YORK TIMES, THE WASHINGTON POST*, and the Indian paper *PATRIOT* have reported that Pakistan has tested a nuclear device. Although this report has been contradicted, would you like to say why these reports were published?

Abdul Qadir Khan: This is a press war and they have better resources in this respect than we have. But, in fact, behind these reports lie the usual hostility toward Islam. By publishing such false and mischievious reports, these people want to frighten the general public and the commercial interests. This is done so that by putting them under pressure, they will not sell any important instruments or technical equipment to Pakistan. You should give a crushing reply to such baseless propaganda.

Question: Several countries, including the United States, are against Pakistan's atomic program. The Soviet ambassador recently said in an interview that Pakistan need not follow its atomic program and that the Soviet Union is ready to supply aid to Pakistan in connection with the solar energy, which will meet Pakistan's energy shortfall. What is the motive behind persuading Pakistan not to follow its atomic program?

Abdul Qadir Khan: As a matter of their basic principle, all the developed countries are against the developing countries making any headway toward higher technology. The reason is obvious. They want to keep their markets in shape and they want to keep others in need of them. In this respect, the reasoning of both the Soviet Union and the United States is the same. As far as atomic energy is concerned, much progress has been made in this field in the last few years and it is for this reason that developing countries are keen on having this source of energy. On the other hand, solar energy is also getting through its preliminary stages. Much time and capital are required to make it meet public energy needs. As far as the question of giving up our atomic energy program and obtaining solar energy without any cost is concerned, it reminds me of the spontaneous answer which Dr Usmani gave to an American representative. The question was: Why does Pakistan exert so much effort and spend so much money on wheat crops? We are ready to meet all your wheat needs under the PL-48 program. Dr Usmani's answer was: "If burials were free, would all Americans be prepared to commit suicide?" Thus, it is obvious that we cannot give up our atomic research program.

Question: Surely, while working in foreign countries, you must have felt the need to serve your own country. Would you like to state whether you ever decided to act on this feeling?

Abdul Qadir Khan: You should know that every Pakistani who is in a foreign country for higher studies always thinks of returning to Pakistan to serve his own country and to make Pakistan benefit from his attainments and experiences.

When I left for Europe, I made up my mind that after studies I would return to Pakistan and would work for Pakistan's prosperity and welfare to the best of my abilities. After completing my

higher studies, I remained in wait for a suitable opportunity to return to Pakistan. When I returned to Pakistan toward the end of 1975, I found that the ground was fertile for my services. I then gave up my idea to return to Europe. What happened after that is no secret to you.

Question: In your absence you were accused in The Netherlands of stealing some atomic secrets. An investigating committee was set up in this connection on pressure from Israel and the judgment delivered against you was 4 years imprisonment. Would you like to say something about this?

Abdul Qadir Khan: Mr Warsi, *NAWA-E WAQT*, and other newspapers and magazines of Pakistan have thrown sufficient light on the various aspects of my case. To begin with, I must thank *NAWA-E WAQT*, other newspapers and magazines, and the correspondents, who all strongly protested against this judgment. These protests brought positive results and gave moral strength to my colleagues and to my family members that the Netherlands Government had done much injustice to me by resorting to courts of law. I might add here that the Government of Pakistan filed an appeal against this unjust judgment on instructions from the respected president of Pakistan. Our ambassador in The Netherlands, Dr Khurshid Haider, who is a very competent diplomat, is personally looking after this case. In addition, the Pakistan Ministry of Law is going through this case from every point of view to be able to advise our lawyer in The Netherlands.

All these charges and court cases were imposed at the insistence of Zionists and Western anti-Islam elements. Under pressure from Israel, the Government of The Netherlands had set up a parliamentary committee in 1980 to go into this case. Its decision was that neither I nor anybody else in company with me had done any spying or had stolen any secrets and that nothing was handed over by me or by my colleague to any person or any government. However, this committee said that Pakistan had gained much capability in enriching uranium through my experience and abilities and that the Government of Pakistan has made a considerable saving of expenditure in this respect. It is quite contrary to all the canons of law to file a case against me after 4 years and also without giving me any facility to defend myself. Surely, the anti-Pakistan and anti-Islam elements had a hand in it. Moreover, all this was done when there was a great hue and cry in Western Europe about the deployment of American nuclear warhead missiles and the Government of The Netherlands itself was engaged in efforts to have these missiles deployed in The Netherlands. To file a case against me, the Government of The Netherlands wanted to give an impression to its own people that it was totally against the spread of nuclear arms and that anybody who writes even a harmless letter to it — which may not even have been answered — can be sentenced to 4 years imprisonment by the government. In fact, this drama was staged in a futile effort to mislead the public. I am sure that the Supreme Court of The Netherlands, where the appeal has been filed, will invalidate the judgment of the lower court against me. Thus, it will compensate me for the injustice done to me.

The fact is that when this case was brought to the notice of lawyers of other European countries, they expressed surprise and said that no such injustice had ever been done in their own

countries. They said that no case had ever been filed in their country in which a trial was held and a judgment of imprisonment delivered without giving the defendant an opportunity to defend himself. You know that I had sent three cables to the judge trying the case when I heard on 11 November 1983 through the press about this case. These cables, according to the prosecution, had reached there on 11 and 12 November respectively. Even then they hurried up the case and announced a judgment on 14 November. All these things are totally against the demands of justice.

Question: Doctor, the details published in Pakistani papers and periodicals about the filing of the case in the courts of The Netherlands and the reaction thereon clearly prove that the Kahuta project had no connection with the Atomic Energy Commission. What was the object of the Atomic Energy Commission in setting up a new scheme under the supervision of the government in connection with this project?

Abdul Qadir Khan: You know that if more air is pumped into a tube than it can absorb, it will burst and its usefulness will be turned into its uselessness.

Any scheme which is enlarged more than necessary loses its usefulness and all efforts made toward this end are wasted in resolving administrative difficulties. Problems of the people grow. There are so many huge departments which are not working according to their strength. If these are divided into several smaller departments then most certainly their output will grow. The Atomic Energy Commission is a very big organization. I am not sure, but I think 6,000 scientists and engineers are working in this organization. Its activities extend from atomic electrical power to medical and agricultural fields. A news report says that even a cure for infertility in women is being dealt with in this commission.

Enrichment of uranium is a highly complicated and difficult job. This needs revolutionary steps. We needed independence in our tasks. The government took an entirely wise step and allowed this scheme to work independently. The president and the minister of finance were very farsighted and kind and they allowed us to work independently. I am proud to say that I and my colleagues came up to their expectations. There was no other reason to let this scheme work independently except to guarantee its success.

The president and the government have repeatedly assured us that this program was meant for peaceful purposes only. We have worked round the clock to give Pakistan an enviable position in this field. In addition to our own scientists and the engineers, the Army engineers have also done a wonderful job in this respect. Shoulder to shoulder with their civilian colleagues, the Army engineers have done an admirable job in the electrical, electronic, and mechanical engineering aspects and they have earned praise from everybody. The Air Force engineers have also set an example in this field. Lastly, I would say that without the encouragement and guidance of President Gen Muhammad Ziaul Haq and Finance Minister Ghulam Ishaq Khan, this work would not have been finished. They encouraged us at every step and provided us with every facility.

Question: A number of projects have been taken up with great enthusiasm, but as time passes their completion seems to be coming to a sad end. The Kahuta project is the only project which has been praised even by our enemies. This project has placed Pakistan on a very admirable stage in the international atomic field. Could you give us an idea about the reasons for its praiseworthy success?

Abdul Qadir Khan: As regards other projects, only the officials responsible for those projects can throw light on them. As far as we are concerned, I and my collegues decided that we would complete this project even at the cost of our lives. We have never cared for the restrictions placed on us by anti-Pakistan foreign countries. We have never complained to the government or to anybody else that such and such a country has stopped our equipment or has delayed its delivery. By working round the clock, and with the grace of God Almighty, we have achieved so much progress that we now can manufacture everything we need. We can now manufacture the most difficult pieces of equipment which we need.

Laurels for all this go to my colleagues. By working 12 to 13 hours a day and even working on holidays, they have made Pakistan self-sufficient in this most important field. If you knew my daily commitments, then you must have known that I am never able to leave for home before 1930 or 2000. The same is the case with my colleagues. They feel proud of their work. Our engineers and scientists are no less competent than the scientists and the engineers of other countries. They only need to be told their priorities. My colleagues have never doubted my good intentions nor have I had any doubts on their intentions.

Secondly, I have full confidence in them. I am working on ademocratic basis and have given them full authority to select their colleagues and methods of work. I am very fortunate that I have had an opportunity to work with such patriotic Pakistanis. Mr Winston Churchill visited Egypt during World War II. He addressed the 8th Army Division and said: If anybody asks you what role you played during World War II, all you need to say is that you fought with the 8th Army. For me also, it is matter of great pride that I had an opportunity to work on the Kahuta project along with the most able and patriotic Pakistanis. It is essential for the success of any project that we should know the goal of our job. If you work on a PhD thesis and you say at the start that you have to perform this task and solve this difficulty, then you have already accomplished 50 percent of the task. The remaining 50 percent then would not be difficult. A famous British author, G.K. Chesterton, has said in most clear words: "It is not that they cannot see the solution, it is that they cannot see the problem." The same weakness is common in Pakistan. There are a number of organizations and schemes, but their directors have failed to point out their goal and to accomplish their assigned task.

Question: You have spent more than 7 years working here but I have never seen you in any conference or meeting. Is there any specific reason for this?

Abdul Qadir Khan: Finance Minister Ghulam Ishaq Khan once said that there should be a conference on conferences because it was essential to find out the feasibility of holding

conferences. If you are engaged in your work faithfully and sincerely for about 7 to 8 hours a day, then how can you find time to participate in conferences with a plate-size label on your chest? I consider conferences a means of propaganda for those who use them to advertise themselves after they have failed in the tasks alloted to them. In our project, meetings and conferences have disappeared. I daily tour my department and all talk concerns the work itself. We all, the directors, take our lunch together at one place. If there is any important point, we discuss it there and then and find a way to solve it. This method of work has proven very satisfactory and we have not wasted our time in any way. At the national level also, this method of work would prove most effective and there would be no need to hold conferences. The science and technical departments can thus save their time and money. If you arrange for a very small conference, you will learn how much time and money is spent on it and the result is nil.

Question: Our standard of education has fallen miserably. Western standards aside, our standard of education is lower than even that of India. Can you advise us on its improvement?

Abdul Qadir Khan: When I was minister of education in Karachi, the dates of examinations were never changed. Classes were held regularly and exams were held on time. Respect for teachers was equal to the respect the students held for their parents. Unfortunately, the era of the late President Ayub Khan ruined the system of education in Pakistan. Since then, we have continuously been on a downward trend. Politics are more in vogue than education in the educational institutes. Nobody has any respect for the teachers. Eduation takes from 6 to 7 years to complete instead of 4 years.

Fortunately, the president of Pakistan understands this difficulty. By appointing Dr Muhammad Afzal as minister of education, he has taken the first step toward education reforms. Dr Afzal is a very learned, competent, and experienced education specialist. He has sufficient experience in the technical field also. He has made statements on education without mincing words during the last few months. He is doing his best now to put the education system on the right path. You probably know that Hippocrates once said: "Extreme remedies are most appropriate for extreme diseases." It is most essential to ban all political and other activities which distract students from their education in the educational institutions. Our country is a developing country and we cannot afford such luxuries as studies which could be completed in 4 years taking 7 to 8 years to complete.

It is essential to hold examinations on time. Those male and female students who cannot complete their courses in time should be expelled and more hardworking students should be enrolled. If you do not treat this disease with a firm hand, it will continue in our country in addition to wasting time.

Question: Not only have the Pakistani mass media but the foreign media and technical experts have identified you as the founder of the Pakistani atomic program. Some patriotic elements have said that the Qu'ade A'zam laid the foundation of Pakistan and you with your work have guaranteed the security of Pakistan for all time. A foreign paper said that after the Qu'ade A'zam and Iqbal your name will remain alive in the history of Pakistan. The fact is that prior to the Kahuta project,

our position in the atomic field was nil. Now we hold an honorable position, by the grace of God, in the Western world and in the world of Islam. All this is due to your sacrifices and research. Would you like to say anything in this respect?

Abdul Qadir Khan: Please understand that all the successes achieved by us in this important field have been aided by the president and the finance minister. It would have been almost impossible to complete this difficult and important task without their guidance and encouragement. As far we are concerned, I and my colleagues, we have only done our duty. Sacrifices were made by Pakistanis when Pakistan was created. Then later, the patriots sacrificed their lives in 1965 and 1971 without any grudge. My sacrifices and those of my colleagues are nothing compared with those referred to above. This is our country and it is our duty to serve and safeguard it.

When the time comes, God willing, you will not find us lacking in our duty as compared to others. We are grateful for those praises lavished on us by our brothers and sisters and we ask that when they pray, they should include us in their prayers and sacrifice everything for the progress and development of our country and the nation. We are very fortunate that God has given us this land. Look at the sacrifices and the hardships of the Palestinians. When you have no country of your own, then everybody treats you shabbily; they only praise you outwardly. Nobody helps you in any practical way. We should safeguard our country more than our own lives. This can only be done through education and honesty.

Question: Tell us something about your childhood?

Abdul Qadir Khan: You may have become aware through the papers and magazines that I was born in Bhopal. Bhopal was a well-known Muslim state in undivided India. Its people were simple and religious. There, I had never heard of factions or knew any existed before I came to Pakistan. Our city was full of mosques. The number of people who had memorized the Koran was greater in Bhopal than any other state or city. The late Nawab [Nobob] Hamidullah Khan was a very able person. His services to Pakistan are known to all.

People from Bhopal have been quite prominent among Pakistani officials. People like Ghulam Mohammad, Shoib Qureshi, Sir Muhammad Zafarullah Khan, and the late Allama Seyyed Sulaiman Nadvi lead the list. I have been saying my prayers in the wake of Sulaiman Nadvi. My grandfather and his father served in the Army. My uncle Mahmud Khan was an official in the revenue department. Another uncle, Muhammad Amar Khan, was a magistrate and also served as a "divan" [high civil office]. My cousin, Himayat Ali Khan, was chief engineer. My father, the late Abdul Ghaful Khan, served as a headmaster in a high school and then as superintendent. He had a bachelor of arts degree from Nagpur University and he was very good in mathamatics and the English language. He served at Dubbulpore, Nagpur, (Bhisawal), and Akola. He preferred being a headmaster to being a superintendent so that he could be near the family and supervise our education.

Everybody in Bhopal was aware of his attachment to his family and everybody respected him. My father and mother had always helped the poor and had helped in their education. My father was a descendent of the famous Hakim Ajmal Khan and my maternal grandfather had been the commander of the Bhopal state force. My elder brother is a senior vikvsident in the state bank at Karachi.

I received my education up to matriculation in Bhopal. Even today, I become nostalgic when I recall the streets of Bhopal and the friends and companions I had there. Just consider Bhopal as a second Switzerland if you will. Hockey was very popular there. I was a good hockey player. I was also fond of fishing but I was quite crazy over kite flying and was also punished for that craze. However, I never quit kite flying. Rules regarding kite-fighting are different in Pakistan than Bhopal. There we would pull the line. Here in pakistan the line is given slack to produce the same action. Here I believe the people would start a fight if the line is pulled. It was probably for this reason that I never touched kite flying after I came here.

In Europe, I played volleyball and played it well. In 1952, I arrived in Pakistan through Khokhropar walking on hot sand with a tin trunk on my head across the border from India. In Pakistan, I received my bachelor's degree and then went to Europe, about which you are well aware.

Question: There is one question that is in the mind of every Pakistani: Can Pakistan make an atomic bomb?

Abdul Qadir Khan: You have me cornered. I do not know whether to say yes or no. Either way, I get caught. First of all, I must say that our atomic program is peaceful. The president of Pakistan and the Pakistani Government have repeatedly offered assurances about this. We are doing all this for power production. The enriched uranium fuel at the Kahuta plant is for reactors which will be built to produce electricity. However, there is one point I would like to make clear. The whole world knows that the technique for making enriched uranium is a very difficult process. The first pilot plant for this purpose was set up in (Almelo).

Knowing the advantages of this modus operandi, Japan spent a large sum and is involved in building a plant. The United States has also started work on a $10 billion plant which will be completed in 8-10 years. This modus operandi — lasers etc — has made no noticeable progress and there is not a single pilot plant or laboratory in the whole world.

A book and article published in 1983 confirm the fact. The question is now one of our abilities. We have made major strides in this difficult field and we have a team of patriotic scientists and extremely brilliant engineers and local experts in the fields of metallurgy, electronics, mechanical engineering, etc, which is not found elsewhere. In brief, Pakistan has a proficient and patriotic team capable of performing the most difficult tasks. Forty years ago no one was familiar with the secrets of the atom bomb and education was not so widespread, but American scientists did the job. Today, 40 years later, we have ended their monopoly in this most difficult field of the enrichment of uranium in only 10 years. This job is undoubtedly not beyond our reach.

India achieved this 10 years ago, although other countries definitely assisted it. We have the capacity to complete such a task. This is a political decision in which my colleagues and I have no concern except for the sake of the country's safety and security. Our honorable president had to make such a momentous decision and we were entrusted with this duty. We, my friends and I, will stake our lives but we will not disappoint the country and the nation, by the grace of God. In short, I wish to say that if India could accomplish such a feat 10 years ago, we are not so abnormal or mentally retarded that we cannot do this, and God willing, we will do it better as we have proved in the field of uranium enrichment.

Question: By completing such an important project in such a short period, you and your associates have opened everyone's eyes, showing us that if we do something sincerely and honestly then we will definitely be successful. Do you have any other projects in mind which you and your team can complete in an appropriate manner and play a significant role in the country's progress?

Abdul Qadir Khan: President General Ziaul Haq, Finance Minister Ghulam Ishaq Khan, and their friends are fully aware of our capabilities and shortcomings. My friends and I have placed ourselves at their disposal and if we are entrusted with any task, we will not betray their confidence and we will not disappoint the country and the nation.

Question: What message do you have for the younger engineers and scientists of the country?

Abdul Qadir Khan: Honesty of motives, industriousness,and willingness to bear hardship for the service of Pakistan,which have been bestowed on us by God. Whenever you are entrusted with a job, read all the relevant literature and use the beneficial things in your practical work and cultivate the habit of reading in the evening. If they are certain that the leaders in their locality are really dishonest and are intentionally engaged in selfishness instead of the larger and higher interests of the nation, then they should not hesitate to voice their opinions.

Question: Are you fond of poetry?

Abdul Qadir Khan: It is only confined to reading and listening to lyrics. I listen to cassettes of Munni Begum and Malika Pukhraj and Master Ayaz Qawwal [Pakistani singers] and feel at peace. "For 100 years the profession of my ancestors has been military, poetry has never been my form of livelihood." [Urdu verse]

Of course, I am very fond of cooking and I used to cook Pakistani food every day in Europe and my wife and children loved it. The children insist even now that I should make parathas [flat bread fried in butter] as they are better than the ones the cooks make. I am particularly adept in making pilaf, kebabs, qormah [spicy meat stew], curry, and vegetables. Since I returned, I have not had any time and I could not fulfill my children's requests.

Question: The Western countries have always threatened that Israel or India will destroy the (Kahorh) plant. After the barbaric assassination of Dr Yahya (al-Mashhad), the government should

make some arrangements for your safety as well. Are you satisfied with the government measures?

Abdul Qadir Khan: The analogy with Iraq is not correct. The conditions in both countries are different. As far as the (Kahuta) plant or my safety are concerned, the arrangements made by the honorable president for myself and my colleagues are quite satisfactory. I am not concerned for myself, it is in God's hands. At such a time, any amount of security arrangements are futile, but nothing will be achieved by eliminating me because we have a large number of intelligent and capable engineers and scientists who can set up another 100 plants like the one at (Kahuta). This technology is ours and we have achieved proficiency in it in this country. All the necessary equipment is produced in the country. It is the result of a venture which is 100 percent Pakistani. Eliminating me or a few other Pakistanis does not eliminate this technology. If in the future the need arises, we will make 10 other plants like the (Kahuta) plant.

You and the Pakistani people can remain confident that the president and the government have considered every aspect of the matter and the necessary steps have been taken. As chief of the Army Staff and with 40 years of military experience, no other person is capable of understanding this as well as the president. This is why we do our work without any fear of danger and in a calm manner.

Question: Your wife is from Holland and her parents and relatives are there. Does she have any problems or experience any discomfort in Pakistan?

Abdul Qadir Khan: You know that Napoleon said that behind every successful man there is a woman. All my success is due to my wife who has given me the maximum cooperation and has encouraged me and has never once complained or argued about my lack of leisure time. My close friends are witnesses to the fact that she is more Pakistani than some Pakistanis. Contrary to some Pakistani women or foreign women married to Pakistanis, who have retained their nationalities and malign Pakistan and are unfaithful to the salt of the land even after partaking of it [reference to Pakistani proverb], my wife considers Pakistan her homeland and has gladly accepted Pakistani citizenship and like a true patriot has never ever found fault with it. Believe me, if my wife's moral support had not been forthcoming, then it would have been difficult, in fact, impossible for me to do my work peacefully and with the necessary concentration.

CSO: 5100/4707

PUBLIC CONCERN OVER KOEBERG 'JUSTIFIED'

Cape Town THE CAPE TIMES in English 31 Jan 84 p 3

[Text]

THE public would be justified in associating the Koeberg nuclear power station with events in the nuclear holocaust film, The Day After, as long as the government refused to sign the nuclear non-proliferation treaty or to categorically deny any wish to develop nuclear weapons now or in the future.

This is the view of the anti-nuclear lobbying group, Koeberg Alert.

Reacting to the plea by the Atomic Energy Corporation's press liaison officer, Mr Dries Sonnekus, for the public not to allow the film to "prejudice" them against civilian applications of nuclear energy, Koeberg Alert said the line between military and peaceful uses of nuclear science had always been extremely vague.

"The civilian use of nuclear power grew out of military application and even today there is little or no distinction between the two.

"In 1974 India surprised the world when it exploded a nuclear device which had been built from materials obtained ostensibly for a civilian research reactor.

"In 1979 the Israeli Air Force bombed and destroyed an Iraqi civilian reactor, allegedly built to produce weapons material for an Iraqi bomb.

"More recently there has been widespread alarm about a reported Argentine nuclear weapons capability, again obtained under the guise of a civilian nuclear programme.

"With very few exceptions, most Western countries with well-developed civilian nuclear power programmes are known or suspected to possess a nuclear weapons capability. It is undeniable that a nuclear reactor which produces electricity can be linked to nuclear weapons."

In response to Mr Sonnekus's claim that "no death can be directly blamed on the application of nuclear power", Koeberg Alert cited two cases where workers at plants had died after radioactive contamination.

"In 1961 three workers died at the Idaho Falls test reactor, while two workers died at the Jaslovske Bohunice reactor in Czechoslovakia in 1976. In both cases the deaths were acknowledged by the authorities only after a considerable interval."

Koeberg Alert said that the scene after a major accident at a nuclear power station would bear a close resemblance to those showing delayed radiation sickness in The Day After.

"Such an accident could potentially release hundreds of times the radiation released during the Hiroshima or Nagasaki bombings."

CSO: 5100/21

BRIEFS

REACTION TO NUCLEAR FILM--East London--A film about nuclear devastation, The Day After, billed as "perhaps the most important movie ever made" left East London audiences unmoved when it opened on Friday. Most of the cinema-goers interviewed thought that the horror shown in the movie was accurate or understated but shrugged helplessly with "what-can-I-do" attitudes when asked if the film had moved them to protest against nuclear weapons. "There will be nowhere to go after such devastation," one East London viewer said. "Who would want to be alive?" Other cinema-goers felt that the movie had not dealt with the genetic and chemical implications of a nuclear attack and the resulting radiation. "The film should be shown to the leaders of countries with nuclear weapons," one cinema-goer said. "Maybe if they see what the missiles will do we won't ever have a nuclear war."--DDR [Excerpts] [East London DAILY DISPATCH in Entlish 30 Jan 84 p 4]

CSO: 5100/21

LONG-RANGE STUDY OF CANCER INCIDENCE NEAR PLANTS BEGINS

Helsinki HELSINGIN SANOMAT in Finnish 11 Jan 84 p 9

[Text] Porvoo (STT)—The Radiation Safety Institute and the Finnish Cancer Foundation are initiating a long-term detection study to determine the extent to which areas in the proximity of nuclear power plants are exposed to cancer. In this study the appearance of various cancer types will be compared with one another in different towns.

Observations will cover all of the East Uusimaa towns that are in the vicinity of Loviisa and the towns in Satakunta in the vicinity of the Olkiluoto power plants. The country's other towns will serve as a basis for comparison. In connection with this comparison, they will also study the effects of exposure to cancer on the big cities and industrial areas.

According to Radiation Safety Institute special investigator Kauko Rytomaa, the fact that, due to their small number, rare cases of cancer are not evenly statistically distributed throughout the country is the reason why they have accelerated the execution of this study. When the apparent accumulation of these cases zeroes in on a town close to a nuclear power plant, for example, the public easily draws the wrong conclusions. Afterwards, it is difficult to convincingly demonstrate that it is due to statistical chance.

Although the study will be regionally and temporally extensive, the investigators believe that the data derived from it must in part be quickly applied. Several types of cancer do not become evident until many years after exposure to them, but leukemia and cancers that affect children, for example, become evident in a much shorter period of time. On the other hand, due to the slow development of cancers it may take decades before it can be shown on the basis of a population study that nuclear power plants do not increase susceptibility to cancer.

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CSO: 5100/2540

OVER HALF OF POPULATION STILL OPPOSES PURCHASE OF NUCLEAR PLANT

Helsinki HELSINGIN SANOMAT in Finnish 11 Jan 84 p 29

[Text] Over half of the population of Finland still take a negative view of the construction of a fifth nuclear power plant and only a fifth of them unreservedly support the procurement of a new nuclear power plant. According to an opinion poll ordered by industry, problems involved in the handling of waste are regarded as the worst aspect of a nuclear power plant. Every third person interviewed also felt that nuclear power plants are dangerous.

The latest Gallup poll on nuclear energy was ordered by industry's so-called basic energy project. For the poll the Finnish Gallup Company interviewed 1,509 Finns in about 100 localities last October-November.

In industry's latest opinion poll no essential differences were noted in comparison with earlier surveys. In opinion polls ordered every other month by the Power Plant Association, a slight tendency toward a more favorable attitude was noted immediately after the parliamentary elections in the spring.

According to a poll conducted by the Power Plant Association in November, 55 percent of the population still said no to a nuclear power plant. The number of opponents was nearly the same as when these surveys were begun a year earlier. During the parliamentary election campaign, however, opposition to nuclear energy rose by 10 percentage points.

Opponents also Believe That Energy Needs Are Growing

According to the extensive survey conducted by industry, the general public believes that energy consumption will increase over the next few years. Two-thirds of the population believe that industry and transportation's energy needs will grow. Opponents of a new nuclear power plant are also of the same opinion regarding the increasing need for energy.

Almost 90 percent of those interviewed believe that the consumption of electricity will increase. Eighty percent of those interviewed believe that the consumption of natural gas will rise. They also believe that the percentage of electric power produced by nuclear energy will increase.

Those interviewed in the poll did not believe that the percentage of energy produced by domestic sources will increase over the next few years. They also failed to believe that the percentages of coal, oil and solar energy would increase.

Those who were interviewed were also asked how they felt as a matter of principle about the use of nuclear power as a source of energy. Fifty-one percent of the respondents in general took a negative view of the use of nuclear power. Five percent of those interviewed gave completely affirmative replies. The largest group consisted of those who, on the one hand, reacted favorably and, on the other, negatively. Women viewed the use of nuclear power more unfavorably than men did. According to director Pentti Sierila, who presented the findings of the poll, over half of the men now in principle approve of nuclear energy.

According to Sierila, the opinion poll that has just been conducted will produce no changes in industry's information policy. The placement of emphasis may, however, in some respects change.

According to the poll, there are clearcut differences in the sort of information supporters and opponents of nuclear energy receive. Defenders of nuclear energy have, in their opinion, received appropriate information on nuclear energy, whereas most opponents say that they have received too little information.

National Referendum Desired

Half of those interviewed would support the choice of a new type of power plant by a national referendum. Of those interviewed 26 percent would grant Parliament the power to choose and 15 percent favored a decision by the government.

According to general manager Krister Ahlstrom, who heads the basic energy project, industry is satisfied with the results of the poll that has just been conducted sine in light of the poll opposition to nuclear energy has lessened. Since opposition to nuclear energy is no longer viewed as a primary issue.

A large number of opinion polls on nuclear energy have been conducted within a short period of time. An earlier poll conductor was the Statistics Center, which was commissioned by the television news. According to the results of that poll, published at the end of December, 77 percent of all Finns opposed procurement of a new nuclear power plant. Eighteen percent of the respondents supported the project.

In Sweden they believe that support for nuclear energy will grow as we move toward the close of the millenium. According to a poll by the magazine DAGENS INDUSTRI, 43 percent of the Swedes feel that the attitude toward nuclear energy will be more positive than today by the year 2000.

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CSO: 5100/2540

POWER AUTHORITY BEGINS TESTS FOR ROCK BURIAL OF WASTE

Helsinki HELSINGIN SANOMAT in Finnish 18 Jan 84 p 29

[Text] The Industrial Power Company (TVO) is beginning to conduct drilling operations in bedrock at Lavia in Pohjois-Satakunta that are aimed at depositing highly radioactive nuclear waste in Finland's bedrock.

The first target for investigation, the Katossuo area near Lavia, may also become a final location site for nuclear waste, depending on the results of the study.

About 20 sites in Finland are right now competing with one another for the location of nuclear waste in addition to Katossuo near Lavia. According to TVO, the alternatives will be pruned down to from 5 to 10 sites by 1985. The location site areas to be studied will also be specified at that time. By 1992 there will be no more than two or three areas left, from among which the final one will be chosen.

While Lavia might be chosen as a burial site for nuclear waste, according to TVO local residents need not get nervous over the fact since they would not begin to use the final site until 2020. According to the Council of State resolution, however, the final location site must be decided on no later than the end of the millenium.

Drilling will begin at Lavia in March in an area that contains a gently sloping granite outcropping. In the spring they will drill a hole between 700 and 1,000 meters deep in the rock. In 1984-1985 various tests will be made in it.

News Surprises Town Fathers

According to general manager Magnus von Bonsdorff, TVO decided to choose Lavia last week. The town was notified last Thursday that it would be informed on the matter at the municipal government's Monday meeting.

Municipal director Jorma Ravio said that the briefing was conducted in a businesslike manner and that there was no sign of any real opposition to the project. Members of the municipal government understood that what is involved is only a research operation. No decisions were made by the municipal government on the conduct of the project.

Rauma-Repola Land

TVO will begin to drill in an area which up until the past few years was an almost virgin wilderness. The drilling operations will be conducted on land belonging to the power company's partner, Rauma-Repola. Rauma-Repola owns several hundred hectares of forest in the area.

Proprietary relationships were of great importance in deciding to choose Lavia. The fact that, as the investigators see it, the site is at a suitable distance [from an inhabited area] also argued in favor of Lavia. Among others, the State Technical Research Center and the University of Helsinki Institute of Radiochemistry will engage in research operations at the Lavia drilling site.

Unlike the Imatra Power Company (IVO), TVO will have to itself take care of the fuel removed from the reactor after it has been used. Since the fuel used by IVO can be returned to the Soviet Union, TVO is now considering which would be a better solution: to bury nuclear waste in Finland's bedrock or possibly enter into an agreement to ship such waste abroad.

Under the present circumstances realities speak in favor of TVO's taking care of its waste itself in Finland. The power company is collecting funds for the handling of its waste.

According to assistant general manager Esko Haapala, the cost of handling waste comes to 1.4 pennis a kilowatt hour, or about 10 percent of the price of electricity.

Highly radioactive fuel accounts for about 80 percent of the cost. Moderately and slightly radioactive power plant waste and the plant's unloading expenses account for the rest.

TVO has been storing spent fuel in water basins at the Olkiluoto power plants. The storage capacity will, however, be exhausted in time and, through official discussions, the company is at present applying for permission to build a temporary storage facility at Olkiluoto.

Strict safety requirements will also be imposed on a temporary storage facility since in it they will have to store the nuclear power plant's most troublesome waste for decades to come. Spent fuel is hazardous for the environment for several thousand years.

TVO Reaches a 10-Year Agreement on Uranium

On Tuesday TVO reached a 10-year agreement with a Canadian firm for the supplying of uranium to the Olkiluoto power plants. The contract is worth about 500 million markkas.

The contract signed with Eldorado Nuclear Ltd covers the years 1984 through 1993. Through the agreement TVO will be able to obtain about half of its crude uranium needs.

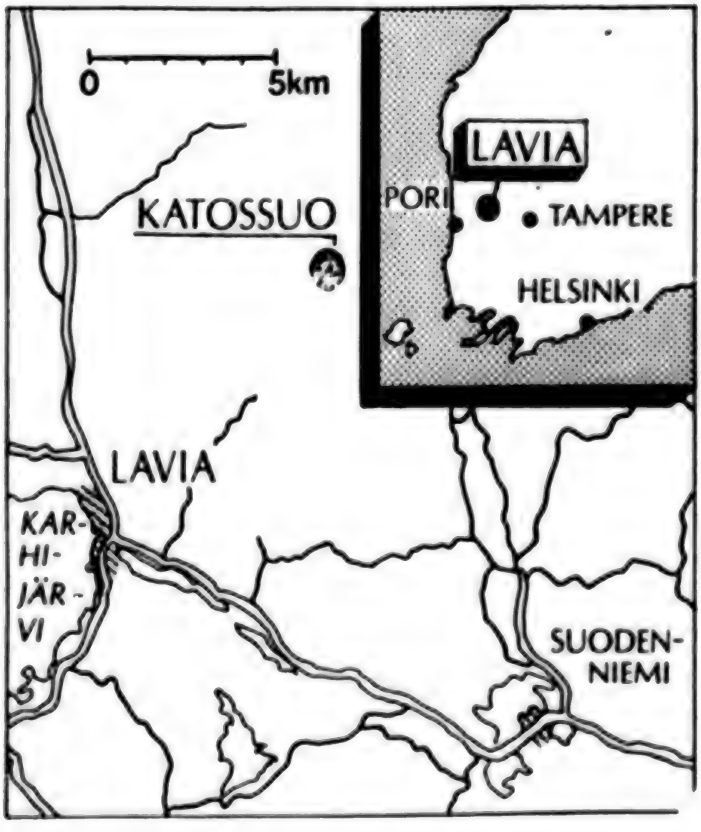
Owned by the Canadian Government and the world's fourth largest uranium producer, Eldorado has been supplying uranium for use by the Olkiluoto plants since 1974. TVO has another long-term procurement agreement with Australia and procurements are supplemented with individual purchases from different parts of the world.

The refinement and preliminary processing of the uranium is performed in Canada. The next stage, the concentration of the uranium, takes place in the Soviet Union, with which TVO has an agreement in effect until the year 2000.

The use coefficients of the Olkiluoto plants have been high. Last year the number-one plant's coefficient was 84 percent and the number-two's 89 percent. In terms of power production this means 10 billion kwh, which corresponds to 250 tons of crude uranium or 40 tons of concentrated uranium.

The agreement that has just been entered into is for 1,100 tons of crude uranium, about the same amount TVO has so far received from the Canadians. All told, Olkiluoto has so far used 2,300 tons of crude uranium.

TVO has enough crude uranium to meet its needs for 2 years in an emergency reserve and enough refined uranium for 1 year.



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CSO: 5100/2540

DETAILS ON FIRST PROCESSING PLANT FOR NUCLEAR WASTE

Rome NOTIZIARIO DELL'ENEA in Italian Oct 83 pp 47-49

[Article by A. Donato, G. Grossi, and R. Nannicini: "A Step Forward in the Vitrification of Waste in Italy"]

> [Text] The vitrification of highly radioactive waste was accomplished in Italy for the first time by ENEA [National Committee for Nuclear Energy and Alternate Sources] at the Ester plant.

A block of about 3 kg of borosilicate glass, which includes highly radioactive waste, has been produced in Italy for the first time.

This waste consists of highly radioactive solutions of fission products which are obtained from the reprocessing of nuclear fuel used in nuclear electric power plants.

After having been used in the power plants, nuclear fuel still contains considerable quantities of uranium and plutonium. These fissile substances are recovered by means of a chemical process which separates them from the rest of the fission products which, in the form of acid solutions, are concentrated in order to reduce their volume and to store them in special tanks.

Although the storage of this waste, carried out in keeping with safety requirements, may be relatively simple from the engineering viewpoint and perfectly acceptable in short-range and medium-range terms, it is now universally realized that, for longer periods of time, highly radioactive waste must be kept in a solid form with such characteristics as to guarantee a minimum risk of dispersion into the environment, considering that they, in terms of radioactivity, constitute about 99.9 percent of all of the radioactive waste producted in connection with the peaceful uses of nuclear energy.

The glassy matrix is considered most suitable for this purpose because of its capacity to encompass all chemical elements present in the waste not only because of the high resistance to chemical agents and to lixiviation but also to radiations.

Highly radioactive waste vitrification therefore today is the most advanced form of tackling--under maximum safety conditions--the problem complex connected

with the treatment and processing of highly radioactive waste and in this sense a major research effort is underway also in Italy.

From this viewpoint, the entry into operation, for its first hot vitrification run, of the remote-controlled minipilot plant Ester is a very important stage; it is part of the complex of the Adeco/Essor cells of the Joint Euratom Research Center at Ispra.

The Ester plant (an acronym which stands for radioactive waste treatment experiments), designed and built entirely by ENEA, is based on a so-called in-pot melting vitrification process of the discontinuous type which was developed by the agency.

The purpose of the vitrification tests now in progress is to produce blocks of borosilicate glass with a real radioactivity so as to be able to do the following:

To determine and control the decontamination factors during the various stages of the process;

To evaluate the behavior--under real operating conditions--of materials and remote-control systems to be employed if possible in the future hot industrial vitrification plant;

To evaluate and optimize the off-gas treatment system;

To produce types of glass having different chemical positions on the basis of a diversity of types of highly radioactive waste;

To evaluate the physical, chemical, and radiation-chemical properties of the real glass types obtained from the viewpoint of their future storage and disposal and deep geological formations.

Cell 4305 Adeco-Essor, which hosts the plant, is so screened as to be able to receive up to 100,000 Ci (1 MeV of energy) of radioactivity.

It is connected by means of Sas [expansion unknown] to two adjacent cells from which it is possible to introduce materials, new annealing [processes], etc., and in which the highly radioactive glass produced can be stored and studied.

The Ester plant is made of two main units which are the frame of the plant as such, inside the cell, and the external control module as well as three support units which are the glove box for depression control, the unit for charging and incorporating the waste to be vitrified, the reagent feed module, and the cold additives.

The in-pot vitrification process used takes place through the following stages:

Transfer of highly radioactive liquid waste from storage tank to evaporator-digestor, where the vitrification additives are put in and where a partial concentration of the solution can be accomplished;

Controlled supply of solution to an inoxydable steel crucible which is heated in a well furnace; exsiccation, calcination, and fusion;

Refining of glass, cooling of crucible and its replacement;

Transfer of vitrification crucible and characterization of glass produced.

The condensate coming from the vitrification furnace is collected, analyzed, and depending upon its radioactivity, it is recycled for vitrification or it is discharged at medium radioactivity. The off-gases go through special filters to capture the ruthenium; then they go through two washing columns, two absolute filters, and finally they are released through the smokestack.

Figure 1 shows the rack (frame) of the vitrification plant as such which has dimensions so as to be able to be extracted, in case of necessity or at the end of the program, from the upper trapdoor of the cell. In the center we see the vitrification furnace with three zones into which the Aisi 310 inoxydable steel vitrification crucible is inserted.

The progress of vitrification is tracked by means of sampling of liquid waste and particle filters, as well as through a continuous check on the most important operating parameters, that is, levels, temperatures, and pressures.

These checks are performed by means of the module shown in Figure 2. Suitably arranged alarm and safety devices make it possible for personnel immediately to go into action so as to restore the normal operating conditions according to the procedures spelled out in the operations manual.

Finally, Figure 3 shows the charging and storage unit for the highly radioactive waste to be vitrified.

It is made up of the Cendillon 15/8 type shielded transport container from which the waste is transferred, through a shielded bridge [conveyor], to a shielded tank inside the shell.

The complete success of the first hot vitrification run at the Ester plant--a plant that was designed and built completely in Italy--is based on a process perfected by ENEA and makes it possible to continue current research activities on the processing of highly radioactive waste under realistic conditions. This means that it will be possible to check the performance of materials, of remote-control mixing systems, and of procedures that could be employed also in vitrification plants of larger dimensions and it will furthermore be possible to evaluate the real performance of the glass types produced from the viewpoint of protection. The Ester plant, which in terms of dimensions and purpose is similar to the Vulcain plant at Marcoule, France, the plants at Richland and Savannah River in the United States, and the FIPS [expansion unknown] at Juelich in the FRG, is an advanced research instrument in the field of highly radioactive waste processing.

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CSO: 5100/2541

ASEA-ATOM DEVELOPING NEW GENERATION NUCLEAR REACTOR

Helsinki HELSINGIN SANOMAT in Finnish 7 Jan 84 p 29

[Article by Risto Valkeapaa]

[Text] "What happened in China is no longer possible."

ASEA [Swedish General Electric Corporation]-Atom has launched a development project aimed at the creation of a new generation of nuclear reactors. They expect to complete the first plant in about 6 years.

The company is trying to develop a reactor that is roughly as powerful as the Imatra Power Company's plant units, one for which the solutions to technical problems are simpler and thus, according to the company, safer than is the case with present-day plants.

Dubbed the Dius reactor, the device was presented last fall in the United States, where the reception was in part enthusiastic and in part cautious. The cautious observers were surprised at Swedish plans to store spent fuel for from 15 to 20 years inside the new power plant. In that way they will be able to reduce fuel costs, but tons of spent, radioactive nuclear fuel will at the same time be accumulating in the plant.

ASEA-Atom's most enthusiastic negotiating partner in the United States has been the Tennessee Valley Authority, which corresponds to our Imatra Power Company. Because of its interest, that agency has built a laboratory model based on the Swedish idea which proves that the idea works.

As for ASEA, it has launched the planning and construction of an experimental plant with a capacity of 3 Mw. Nuclear fuel will not be used at the test plant, but in the company they believe that they will be progressing on that basis 3 years from now.

As things look now, they plan to invest millions of kronas in the sizable project just as they did before when they invested in the development of the ASEA-Atom boiling-water reactor. As a result of that project, two 660-Mw plant units supplied by ASEA are also in operation at Olkiluoto.

Heating Plant Version

The father of the new reactor is Kare Hannerz, whose idea ASEA has marketed for years now as the "Secure" reactor. The Secure is presented as a heat-producing plant and they have also tried to sell it to us to heat the Finnish capital district.

The version that has now been developed is designed for the production of electricity. As far as the reactor is concerned, the basic idea is the same as the one used in the heat-producing Secure.

The idea is based on the fact that the reactor core will under no circumstances reach melting point. Thus what happened in China should not be possible in this new generation nuclear power plant.

The relatively cool water that surrounds the reactor area assures the cooling of the core. If for some reason the hot water circulating in the reactor should even boil off, cooler water would flood the reactor. There is boron in the water, which prevents a chain reaction.

The fact that there is neither an isolating wall nor even a valve between the cool and the hot water assures the flow of cool water into the reactor. The fact that it is relatively difficult for the warm and the cold waters to mix with one another is chiefly what keeps the waters separated during normal operation.

But where will the first plant be built? ASEA still has the same problem as with the heat reactor. It cannot build a protoype in Sweden and so it cannot itself demonstrate that its plant works either. On the other hand, it needs foreign collaborators because it will cost an enormous amount of money to develop the new reactor.

The plant itself should, however, be capable of competing favorably in terms of cost. More exact cost estimates can only be made in a year's time, but at present they already know that the plant will be cheaper than types currently in use.

They will also achieve a relatively favorable cost because, among other things, neither complicated emergency cooling systems nor even control rod machinery will have to be built into the plant. The plant capacity can be controlled with boron, the concentration of which in the reactor controls the capacity.

What Would It Look Like?

Despite the theoretical simplicity of the new reactor, describing its internal workings means presenting a jungle of pipes. From the outside the new nuclear power plant looks like a massive block of concrete. The reactor is surrounded by a concrete silo 60 meters high and 30 meters in diameter, the space inside of which is 13 meters in diameter.

The concrete silo is built as strong as can be since it is designed to be built by means of the same process as the high pressure compressor. Among other items, industrial diamonds are pressed out of coal in the compressor under enormous pressure and heat.

They have been thinking of locating the concrete silo in part inland where there should be no chance of the water coolant's flowing elsewhere.

Aren't the Old Ones Safe?

In boasting about its new reactor, ASEA has run up against a problem that will make marketing it more difficult. Although the safety factors are most essential in the new model, it has been hard to loudly advertise them in the United States, among other countries, since the question readily arises: Then the old reactors aren't safe in spite of all the assurances?

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BLASTING BEGINS FOR BURIAL SITE OF FORSMARK NUCLEAR WASTE

Helsinki HELSINGIN SANOMAT in Finnish 8 Jan 84 p 34

[Article by Risto Valkeapaa]

[Text] Untitled, as is the Swedish way, Tonny Jansson sets the tip of the Finnish-made drill into a suitable cleft in the rock.

Soon the already god-awful racket gets twice as bad and one more drill drives into the gray granite.

We are deep inside the rock traveling beneath the Aland Sea. The walk to the winter sun is 170 meters. The place is the village of Forsmark in the commune of Osthammar.

Almost everyone here is a Jansson. They are now making history, since they are blasting a tunnel through the rock through which future moderate and slightly radioactive waste from Sweden's nuclear power plants will in time be tossed to its final burial place. All this will cost the Swedes 0.1 of an ore per kilowatt hour consumed.

In nuclear power slang a burial site is called a final location. This one will be the first final location site in any of the Nordic countries.

They are fight now building a temporary storage facility inside the rock farther south, at Oskarshamn, for the most radioactive waste, spent fuel. The temporary storage site should be completed by next year. No decisions have yet been reached on a final burial site for spent fuel.

Protests

The Janssons have been drilling through the rock at Forsmark since last summer now. Before that a tough fight was engaged in as to whether they should in general allow such a storage facility to be built anywhere at all.

Finns too, Alanders, got nervous over a year ago when they conspicuously began to discuss plans for it. They, however, got over their nervousness.

As late as last summer demonstrators marched in the rain from Gavle to protest. But now Jansson is drilling through the rock like mad and plans to be able to blast chambers for the waste in a year's time.

In a year's time two 1,400-meter-long corridors should be finished. One of them goes down and the other up. The waste storage chambers should be completed by 1985-1986. In addition, inside the rock they are building four silos, each 50 meters high and 30 meters in diameter, whose walls will be reinforced with concrete.

About 400,000 cubic tons of rock will be moved from under the Aland Sea to the surface of the earth. That might produce enough for an elegant toboggan run in an otherwise flat region.

Some of the rock will be crushed and some of it used as filling paste. Some of the rock will still be needed for fill since the nuclear waste burial site will at some time have to be permanently sealed off, Ingvar Spanne told us. He is the Vattenfall engineer who is directing operations.

Ready in 1988

The Forsmark waste caves should be ready for waste by fall 1988.

At the height of operations the worksite will provide jobs for 300 men before then and for about 50 on a regular basis.

According to the Swedish plans, 20 nuclear waste Janssons would be needed at the site afterwards. There will be enough work to provide lifetime careers for the toughest of them since the mouth of the caves will in principle be sealed in 25 years time. After that, according to a national referendum, they must not accumulate any more new waste.

When the mouth of the caves is at some future time plugged, the burial site should remain closed for 500 years. The more radioactive waste remains hazardous for the environment that long.

A 50-meter layer of rock above the nuclear waste caves will serve as insulation. That is no depth for any well drillers, much less so for any oil prospectors.

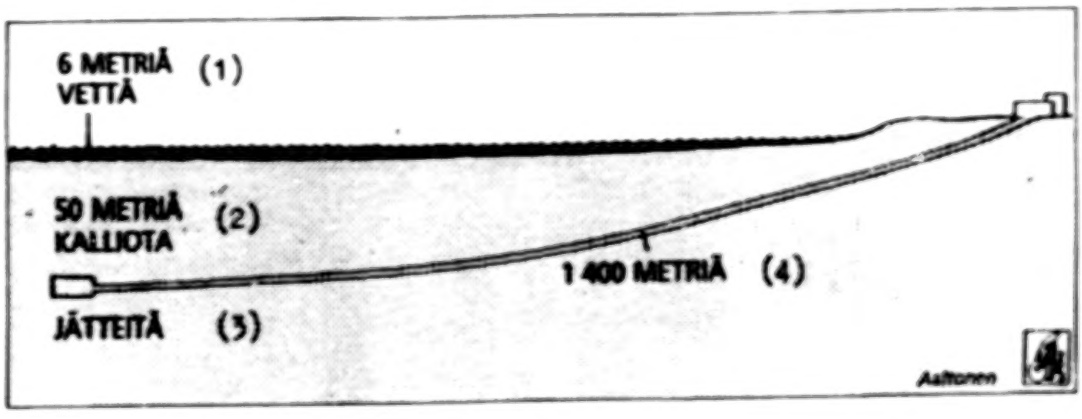
In the opinion of the Swedes, the risks produced by drilling will be avoided by building the burial site under the sea. There will be 5 or 6 meters of water on top of the rock. Even oil prospectors will forget about it: Now what kind of a fool would ever explore for oil here?

The Finns

The Finns have been thinking about building similar nuclear waste burial sites at Hastholmen and Olkiluoto. Both Imatra Power Company and Industrial Power Company plans are progressing at the same rate and, in terms of the present timetable, will be drafted for implementation by 1986.

It is estimated that licensing procedures will take about a year, so that they can in principle begin construction by 1987. Just how soon permanent waste storage sites will be needed is, on the other hand, another matter, since so far relatively little power plant waste has accumulated at the plant sites.

The Council of State requires power companies to draw up their plans in terms of a timetable, according to which the waste storage sites must be completely blasted out of the rock by 1992. This in practice means that blasting will probably begin in the late 1980's.



Key:

1. Six meters of water.
2. Fifty meters of rock.
3. Waste.
4. 1,400 meters.

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